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ABSTRACT

This third annual report provides a comprehensive picture of the work that has been done to construct a prototype of a computer-based Information System for Vocational Decisions (ISVD), the major objective of which is the improvement of vocational decision-making. The report is divided into 7 parts: (1) the inception of the ISVD; (2) its underlying theory and overall design; (3) its work organization with accomplishments to date and future plans; (4) a list of ISVD's personnel; (5) a list of its publications; (6) 2 appendices which illustrate the College Script Network and the Occupational Script Network, through which system users gain access to the data files; and (7) an extensive bibliography. (TL)

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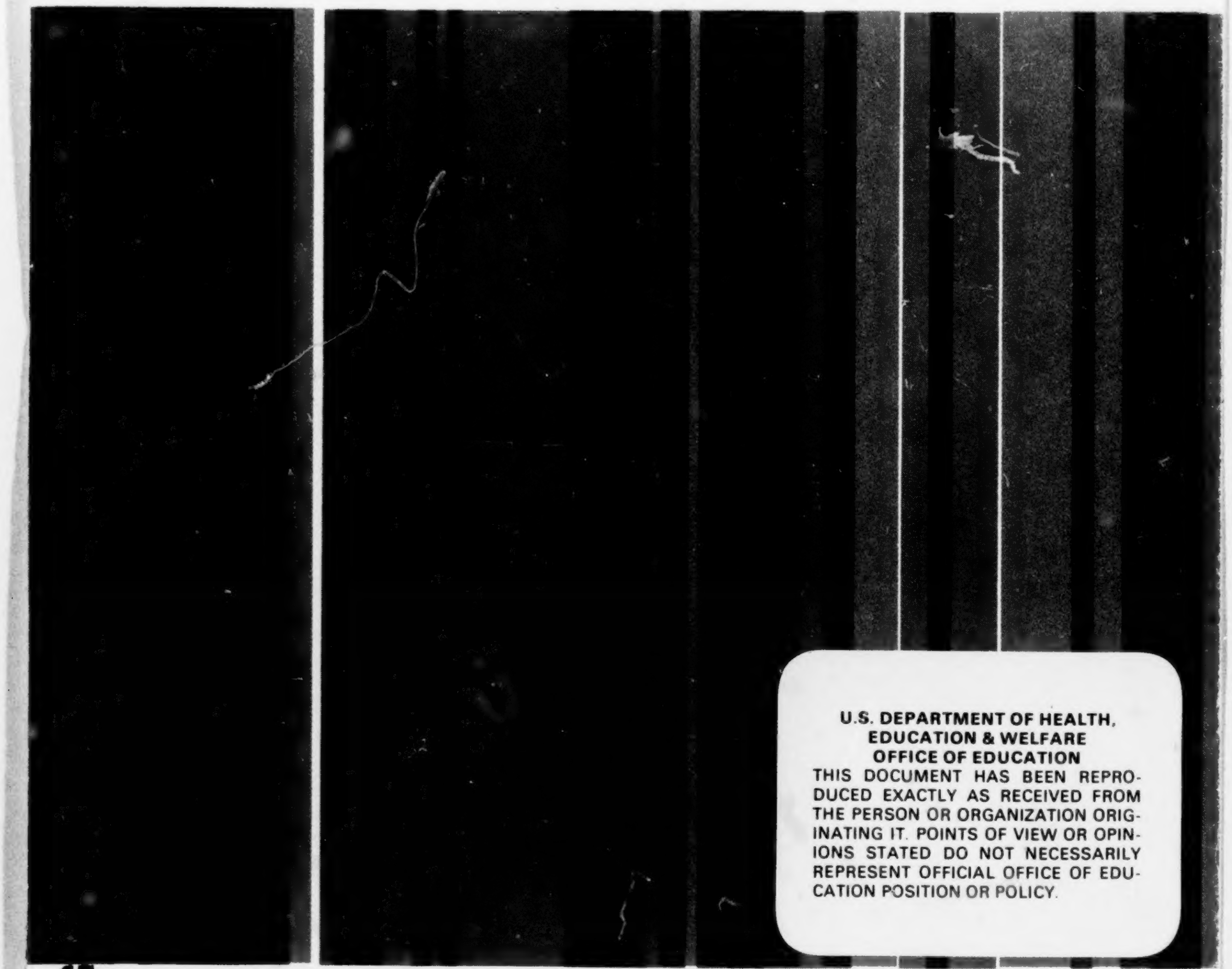
Phase I Conclusion of the
INFORMATION SYSTEM FOR
VOCATIONAL DECISIONS

# *Third Report, 1968-1969*



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HARVARD GRADUATE SCHOOL OF EDUCATION
NEW ENGLAND EDUCATION DATA SYSTEMS
NEWTON (MASSACHUSETTS) PUBLIC SCHOOL SYSTEM

# Third Report

## 1 June 1968-31 August 1969

October 1969

Harvard Graduate School of Education
New England Education Data Systems
Newton (Massachusetts) Public School System

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"Every man is the architect of his own future."

*Appius Claudius Caecus,* Aphorism, *from Speeches to Caesar's Senate, ca. 312 B.C.*

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# *I. The Inception of the Information System for Vocational Decisions*

## INITIATION

The United States Office of Education and the President and Fellows, Harvard College, entered into agreement as of 1 June 1966 to support and construct the prototype of a computer-based Information System for Vocational Decisions (ISVD). The prototype is to be delivered on or before 1 July 1969, thirty-seven months from the date of initiation.

## ORGANIZATION

The Information System for Vocational Decisions (ISVD) is directed by an Executive Committee. (See section on Authority for a list of its members.) Through this particular committee, the ISVD embraces the interests which Harvard University, the New England Education Data Systems (NEEDS), and the Newton School Department have in the construction and field testing of a computer-based, guidance and counseling inquiry system.

## OBJECTIVE

The major objective of the ISVD is to improve vocational decision-making through the use of a computer-based guidance system. The program is to be so designed that the student can relate knowledge about himself to data about education, training, and work and thereby create a body of information on which he can base his career decision. The entire program links person, computer, and teacher or counselor in such a way that the student can conduct a dialogue with the computer, while the counselor assists in interpreting and evaluating the results of the dialogue.

## PROBLEM AS STIPULATED IN PROJECT PROPOSAL

*The following statement is quoted in full from the original proposal entitled* An Information System for Vocational Decisions, *submitted by D. V. Tiedeman, E. Landy, W. J. Fletcher, A. B. Ellis, R. G. Davis, and E. G. Boyer, Principal Investigators, to the U.S. Commissioner of Education under the provisions of Section 4(c) of the Vocational Education Act of 1963.*

". . . participation in an occupation involves more than training in the specific skills required. Before, during, and even after vocational training the process of *decision-making* must also be involved. Central in decisions about occupations, jobs, or courses of study are facts/data[1] about one's self and about work. Facts illumine and frequently create decisions particularly when facts are given the status of data by inquirers. But decisions also create facts. This project therefore provides opportunity to study the interaction of facts and decision, and their subsequent creation of information.

"The proposed ISVD will deliberately play upon a potentially useful distinction between *data* (facts) and *information* (interpreted facts). The task of the information system is to enable the individual to transform data into information. This is to be done by teaching him to interpret the data in the light of his own knowledge, experience, and intention, so that his organization and use of the data represents his own personal relationship to them in the process of decision-making. We presume that only when data are used in this way can they be described as information where the individual is concerned. The information so generated can then, in turn, serve as data in the making of future decisions.

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[1] Occupational facts/data come in two conditions, fixed and modifiable. We therefore elect to adopt the cumbersome term, "Facts/data," to indicate this fact throughout the report. Occupational facts are directly recoverable without modification except for storage and later retrieval. On the other hand, occupational data consist of facts which must be additionally processed by the numeric and/or linguistic routines of a modifying system. Either unmodified facts or previously modified data need to be further mediated if they are to be turned into information. This is why we refer conjointly to facts/data whenever our connotation is associated with information.

"Given that the quality of decisions is directly related to the kind, quality, and comprehensiveness of the *information* (i.e., data in relation to personal intention) considered by the individual during the process of decision-making, then a fundamental task of guidance is to identify, evaluate, and classify needed information *and to make it readily available to counselors and students in useable forms and at needed times and places.* A second task is to learn how past decisions can be used to create information of value to the students who have made those decisions. We speak first of the provision and display of data, and its transformation into information. When we consider the teaching of decision-making, we will discuss the creation of further information by the analysis of past decisions.

"Guidance workers have had difficulty in providing and effectively displaying data. This is so because the amount of these data is directly related to the unparalleled rate of change in the technological world, which in turn is rapidly producing basic changes in our society. If we are to prepare students with skills, and attitudes and understandings for a changed and continuously changing future, we must know something of the nature of the changes involved. We must also encourage students to think of vocational planning as a *lifetime* process, not a one-time decision. 'The counselor must think *future* and not experience or he will be of diminishing value to the student of the sixties and seventies' (Wrenn, 1962, p. 20).

"Not only have counselors found it difficult to provide and display data, but the relatively infrequent contact between student and counselor has made the student's interpretation of data largely a hit-or-miss affair. Most students in secondary schools see a counselor three or four times a year at most. Furthermore, the nature of these contacts is frequently governed by a concern for the immediate next decision to be made ("What courses shall I take next term") and the immediate interest of the student ("I'm interested in science"). The amount and quality of facts available to the counselor at the time of an interview is limited by his own knowledge and his school's resources. And the counselor's usual function is to provide facts for the student at the same time (and frequently without distinction) that he is attempting to get the student to use them.

"What is needed is a system which will provide for the student direct access to all relevant facts without requiring the *direct* mediation of a counselor. This would bring about a change in the counselor's role. Instead of being *both* source and interpreter of facts, he would have the primary responsibility of interpreting the student's *use* of the facts as he transforms them into information. This would require attention to the role of unconscious motivation, and the effort to help the student transform his tacit understandings into explicit ones. Also included in his role would be training the student in the use of the data system, supervising him in its use, and evaluating the student's decision-making process. Ultimately, it should be possible for the student to use the data system in a relatively independent manner for both exploration and decision-making, with recourse to the counselor only when assistance or interpretation is needed.

"Another important factor in the decision-making process is the student's *'sense of agency,'* that is, his awareness that he is an active agent in determining the course of his own career (Field 1964). We feel that many persons, especially those in economically depressed areas who have been socially and culturally deprived, may lack this 'sense of agency' because of a lack of accurate information about themselves and their real ability[2] to act on their environment.

"This proposal is in part an outgrowth of a study conducted during 1964-65 by John B. Carroll and Allan B. Ellis under contract with the U. S. Office of Education (Contract #OE-5-10-097)

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[2] Our colleague, Norman Sprinthall, at Harvard tells us that his recent research with Ralph Mosher and John Whiteley strongly suggests that even secondary school students lack conviction that they *have* any choice in and responsibility for their educational and vocational behavior.

(Carroll and Ellis, 1965). The study was undertaken to determine the nature of a possible data bank and the role such a bank should play in the development of a systematic education program for the New England region. A significant conclusion reached by the investigators was that an educational data bank should not be a static storehouse. To be of real value to the process of education, a data bank must be dynamic enough to become a functional part of the education process.

"This conclusion was of special interest to the New England Education Data Systems (NEEDS), which was established in 1963 by the New England School Development Council and which is affiliated with the Harvard Graduate School of Education as well as with 57 other organizations.[3] NEEDS is an effort to bring the technology of data processing to bear on the administrative, curricular, and guidance problems of the schools of New England. A long-term objective of NEEDS is to establish a regional information center for its member school systems so that, as NEEDS grows, a large body of data will be available to facilitate educational research and development efforts in the region. This proposal is therefore designed to take a major step toward the development of such a comprehensive regional information center in the area of vocational education."[4]

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[3] During 1967-68, NEEDS consisted of 67 member organizations. During 1968-1969, NEEDS consisted of 81 member organizations.

[4] Effective 1 July 1969, NEEDS was purchased by Westinghouse Learning Corporation. The plans of that Corporation are not yet a matter of public record.

# II. Theory and Design

## GETTING A PERSON AND A MACHINE TO IMPROVE IN UNDERSTANDING CAREERS

### PROCEDURALIZATION AND COMPUTERIZATION

A computer literally has many faces. For instance, the physical condition of computers varies from computer to computer. However, the physical variation among computers, which is the more common understanding that the computer is not one but many machines, is not actually the more profound of the possible meanings of the statement that the computer has many faces.

The more profound meaning inherent in the statement that the computer is not one but many machines inheres in the fact that *persons* can also individually accomplish variation in any one of several physically different computers. Machines execute procedures. Therefore, the specification of a procedure in effect specifies a machine. A computer program is a specific procedure. Therefore the writing of a computer program is the design of a machne.

Although persons titled computer programmers do in fact write computer programs, not every computer program has to be written by computer programmers. The common man can write computer programs. In fact, very small children can and have written computer programs.

The Information System for Vocational Decisions is constructed on the presumption that anyone, with instruction, can write computer programs. The system is also constructed on the understanding that, as Ellis puts it, when you proceduralize something you can computerize it but that to computerize something is not necessarily to proceduralize it. The ISVD makes use of this fact in the most basic of its assumptions, namely that *the system is not a system until the person exists in it*. The facts/data in the ISVD are not information until a person places himself in the system and through interaction with it turns the system's facts/data into his information. In order for a person to turn facts/data into information, he must proceduralize understanding of his information making use of the computerized partial system of public facts/data as well as a partially proceduralized system of processes giving him meaning to his intentions as he operates. Proceduralizing understanding of one's information requires the writing of computer programs which can in turn interact wth the system's facts/data. Individually written computer programs (i.e., individually constructed machines) therefore become personal servants by means of which each person can process facts/data to comprehend his self information.

In the context of the ISVD it therefore becomes relevant to address the question, "Can a person and a machine improve understanding of careers?" Since the ISVD "machine" is really the person's proceduralization of his own understanding of his decision making, the "machine" to which we refer in the ISVD theory is the machine which is the person, or at least that part of himself of which he is explicitly aware. Therefore for a person to improve his understanding of his personal "machine" is merely for him to become more articulate about his decisions. The ISVD additionally presumes that increased understanding of decisions can itself be understood as a process and that this understanding maturationally results in eventual comprehension of epigenesis of decision-making development. Epigenesis, or successive differentiation and integration, is a natural part of mentation (Koestler). Comprehension of epigenesis of decision-making development is a particular potential at least of man. Comprehension of decision-making development does not necessarily make a person happier or more powerful, merely more aware. The ISVD holds that this awareness is good and worthy of cultivation as assiduously as possible, particularly with the assistance of computers since their basic form is the basic form of epigenesis of decision-making development when the person becomes an actual part of their advanced systems.

The above essential understanding of ISVD has emerged over the three years in which the principal investigators and staff have worked with its resources and requirements. However, Allan Ellis has been a principal architect of the understanding on which the above assertions are based. The First of the three ISVD Reports dealt with the assumptions and data of the career process which are at present structured into the ISVD as prototypes in order for the person to grow in his comprehension of those processes as specific instances of the more general processes noted above. The Second of the three ISVD Annual Reports dealt more specifically with the role of decision-making in information generation, that is, with the computer's understanding of English as a basic theoretical process and with the construction of data files in which information generation through person comprehension of the partial machine understanding of English holds promise of achieving awareness of self responsibility in comprehending epigenesis of decision-making development. This, the ISVD Third Annual Report remains in the tradition of its predecessors but attempts to enlarge understanding of the fact that we give, *not* pre-empt, responsibility in the ISVD when we computerize some of the career functions without fully proceduralizing them. This is a fact of great consequences to personal motivation.

This section on Theory and Design in this Third Annual Report consists of four parts. First, Ellis and Tiedeman address the question "Can a machine counsel?" That sub-section indicates the basic ISVD form in which the person and the machine are encouraged to improve in their understanding of each other. Next, Tiedeman addresses the question specific to ISVD, namely "Can a machine develop a career?" That sub-section outlines the basic processes of career development which the person will in the ISVD be encouraged to proceduralize with the assistance of the computerized functions of the ISVD. In the last two parts of this section, Tiedeman indicates ways in which the specific career procedure employed in the ISVD can be generalized. The third paper, "Can a Machine Admit an Applicant to Continuing Education?" deals with generalization from career processes to testing processes, testing processes hopefully more appropriate to the encouragement of self-correcting activity associated with admission processes in continuing education. The fourth part both suggests what might happen when the basic ISVD processes are generalized to all of education and speculates on the nature of guidance and psychological service when such changes occur.

## CAN A MACHINE COUNSEL?[1]
## PROCEDURALIZATION

### THE QUESTION AND THE PRIMACY OF PROCEDURE

Just about everyone who spends his time trying to figure out what counseling in education is all about agrees that only human beings can counsel. These men—school counselors, professors of guidance, counseling psychologists, and the like—disagree with each other on all the other matters in their profession and this makes the one thing they agree about that much more powerful. Indeed the power of this agreement and the common sense on which it is based make the question, "Can a machine counsel?" a very strange thing to ask. By it we seem to be wondering whether or not something can be human and nonhuman at the same time, and it must be difficult to imagine how we can take our question seriously. To make matters worse, we are willing to admit, for the duration of the next few paragraphs at least, that people are correct when they say that only human beings can counsel. But we do not consider this any contradiction because we go along with the consensus only to suggest the answer to a question can be unrelated to the posing of it. We assert—and those who recall the works of G. E. Moore,

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[1] This sub-section is based on Project Report No. 17, "Can a Machine Counsel?" by Allan B. Ellis and David V. Tiedeman.

Russell, Wittgenstein, and the other philosophers of language will know this is not a new idea—that the trouble with questions is that they seem so strongly to demand answers. People tend to judge questions by whether or not they can answer them, or on their willingness to live with the answers. But questions are good for other things, of course besides the answers to which they lead.

Our intention with the question is to gain perspective on our feelings about the activity of counseling. One thing a question can do, of course, is lead to other questions, and we hope to get from our perspective a better sense of what those other questions are that must be considered when coming to terms with our idea of counseling. Because of what machines are, we accomplish our task best, we think, by using the word "machine" the way we do in our question.

Machines execute procedures and each machine is the embodiment of the procedure it executes. This is an important relationship that exists for all machines; people are just not in the habit of speaking about machines in this way. It means, of course, that knowing in detail what a particular machine does—how it works—is enough to know what procedure it is executing. The thing that counts about a machine is the way it behaves and this behavior is prescribed by the procedure it executes. All automation, far from being magical as some suppose, is nothing more than the physical expression of well-formed procedures.

When we say that a machine is the embodiment of the procedure it executes, we are saying, in effect, that a statement of a procedure *describes* the machine needed to carry out that procedure. Thus mechanizing means thinking about procedure, not about hardware, and once we state a procedure explicitly we should not really be surprised that a machine can be built to execute it.

To make things simpler in this paper we will confine ourselves to computers instead of machines in general. This poses no real restriction, however, since a computer is a device whose job it is to accept descriptions of other machines and to imitate the behavior of those machines. This description is called a computer program and is usually thought of as a set of instructions for what the machine is to do. But a computer program is more like a blueprint which the computer uses to build itself into the particular machine needed to execute the particular procedure described by the program. It is *as though* the computer were armed with pliers and screwdriver rebuilding itself to conform step-by-step to the elements of our procedure. Having done this, the computer becomes the machine our program described, and it will then function as that machine.

A computer without a program will do nothing, whether or not it is plugged in, because computers are not like other machines. In a sense the computer is not a machine at all in its own right, and yet it can become many machines, in fact, any one which can be fully described to it. For example, one may build an address printing machine, or he may write a program which will turn a computer into an address printing machine. In either case the results will be the same with the exception that even though both machines would be operationally equivalent, they would be different from each other in one crucial respect: the computer can do other things tomorrow. Whereas the power of most machines is in what they do, the power of the computer rests in what it can become, and the essential idea of a computer is that it is an incomplete machine ready to be completed in an infinite number of ways, each way producing a different machine. Thus, a computer program is at the same time an explicit statement of a procedure and the blueprint of a machine needed to carry it out, and whether or not a computer can execute a given procedure depends primarily upon how well we understand the components of that procedure, and how imaginative we are in conceiving procedures in terms of the basic elements of which they are comprised. Centering our attention on a computer, therefore, has the advantage that we depict a machine in terms of such a procedural statement and thus maintain a clearer attitude about machines and their relation to procedures.

Now this attitude about machines is helpful to us because, contrary to first impressions, the form of our question does not impose any preconceived notions on our exploration of counseling. We hope, with this attitude, to avoid the kind of commitment that led Christopher Columbus, for example, to think that

Watling Island was the East Indies or the kind of vision that led Abel Tasman to discover two islands in the Southern Hemisphere and at the same time to sail completely around the continent of Australia without ever noticing it was there.

One thing this attitude about machines—and its subsequent application to the activity of counseling—frees us from is a concern about the physical aspects of machines. If there is such a thing as a counseling machine, we need not worry about whether or not it must have arms and legs. Furthermore, we are freed from the somewhat more general worry of whether or not such a machine should be able to smile or frown or nod sympathetically. We may discover later, of course, that these or similar characteristics are necessary parts of our notion of the act of counseling, but our question does not impose this on us and therefore we do not start out needing to believe that such is the case. In this spirit our question represents a point of view about problems. As with all points of view we do not expect resolution from it, but rather some insight into the topography of the problem under consideration. This is why the answer to the question, even if it happens to come out of our analysis, is secondary to the analysis itself.

## IMITATION AND MEANING

We begin this analysis by considering the meaning of the question, "Can a machine counsel?" To do this we first look at the procedure adopted by the late Alan M. Turing in his consideration of a similar question. In 1950 Turing, who was an eminent mathematician and logician in England, published an article entitled "Computing Machinery and Intelligence" in which he proposed to examine the question of whether or not a machine can think. His first step was to replace this question by another "which is closely related to it and is expressed in relatively unambiguous words." He said:

> The new form of the problem can be described in terms of a game which we call the "imitation game." It is played with three people, a man (A), a woman (B), and an interrogator (C) who may be of either sex. The interrogator stays in a

> room apart from the other two. The object of the game for the interrogator is to determine which of the other two is the man and which is the woman. He knows them by labels X and Y, and at the end of the game he says either "X is A and Y is B" or "X is B and Y is A." The interrogator is allowed to put questions to A and B thus:
>
> C: Will X please tell me the length of his or her hair? Now suppose X is actually A, then A must answer. It is A's object in the game to try to cause C to make the wrong identification. His answer might therefore be, "My hair is shingled, and the longest strands are about nine inches long."
>
> In order that tones of voice may not help the interrogator the answers should be written, or better still, typewritten. The ideal arrangement is to have a teleprinter communicating between the two rooms. Alternatively the question and answers can be repeated by an intermediary. The object of the game for the third player (B) is to help the interrogator. The best strategy for her is probably to give truthful answers. She can add such things as "I am the woman, don't listen to him!" to her answers, but it will avail nothing as the man can make similar remarks.
>
> We now ask the question, "What will happen when a machine takes the part of A in this game?" Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between a man and a woman? These questions replace our original, "Can machines think?" (Turing, 1950)

Now, our interest in Turing's approach is in determining if such a procedure for establishing the meaning of the question will work for us. Can we make use of the idea of an imitation game?

Clearly, there are two kinds of imitation possible and even though Turing was never explicit about their differences, it is possible to think about the imitation game in terms of one or the other. The first of these two kinds of imitation we will call Imitation #1 for lack of some better term, although the word "simulation" comes very close to our intended meaning. Imitation #1 consists in the machine *becoming* the thing imitated. Our question, in these terms, becomes, "Can a machine *be* a counselor?" the implication being that the inner workings of the machine would be identical to a counselor, not a particular counselor or even counselors in general. We mean that these inner workings would be such that the resultant behavior would be counseling.

If we replace our question with some test or other, perhaps one like Turing's, that would indicate whether or not a machine is making a successful Imitation #1 of a counselor, we are quickly in trouble. Aside from the formidable difficulties of constructing the test itself, we are faced with the problems posed by all the new questions that arise out of Imitation #1. Because Imitation #1 requires that the machine *become* a counselor, we must expect it to experience all the relevant conditions in which counselors find themselves. If the counselor cares, the machine must care. If he experiences the dilemma of the counselee in order to mirror its form and substance, then so must the machine. If it is important that the counselor empathize with the client, then too must the machine empathize, and so on through the range of human conditions essential to the counselor when he counsels.

You no doubt see what we get ourselves into by adopting Imitation #1 as our meaning to the question. We are forced to expect the machine to feel what a counselor feels, and this feeling must arise *in the same way* in the machine as in the human being. But this is a contradiction, making the question nothing more than a word game. To expect something to undergo a human experience is to expect it to become human to that extent. On what grounds, for instance, can we say that a machine that feels and loves and cares is not by that very fact human to some degree? We confuse ourselves with this not because we are led to consider machines to be human even though they are not flesh and blood and do not live and die and breathe, but because our words deceive us into thinking we ask something meaningful, when in fact all we have done is wonder if something that can become human can do human things. In light of these difficulties we reject Imitation #1 as our approach.

The second kind of imitation, which we will call Imitation #2, is essentially the approach adopted by Turing in his imitation game. Imitation #2 consists in the machine *behaving like* the thing imitated and in our case there is some hope in this approach. Our question, in these terms becomes, "Can a machine *behave* the way counselors do?" That is, no matter what the real state of the machine, can it give the appearance of being a counselor?

An imitation counseling game in this case would become a test to see if a machine could do as well as a human counselor in exhibiting all those behaviors which make up the relationship between the client and the counselor. For instance, can the machine *exhibit* concern? Can it seem to be honest and trustworthy? Can it generate confidence? Can the machine make utterances which are relevant and of a kind that assist the individual in dealing with his problem? Compared to Imitation #1, this approach seems much more manageable although we probably do not know enough about the act of counseling to be able to catalogue all the things that must be exhibited by this brand of counseling machine.

We see on closer inspection, however, that Imitation #2 is much more troublesome than Imitation #1 precisely because it seems reasonable. It does not clearly reveal its weaknesses and faulty assumptions and thus can too easily lead us astray. One objection is that Imitation #2 is based on deceit. We believe a counselor behaves in order to reveal himself, and this revelation is the mechanism by which he helps the counselee to gain insight. To mirror the counselor's behavior without the substance behind it would be to violate one of our basic premises of what counseling is. Beyond this, Imitation #2 ignores the fact that counseling behavior has its effect only when the client's perception of that behavior is appropriate. Not only must a counselor exhibit honesty, for example; the client must perceive this honesty and believe it. But regardless of its behavior, how do we convince someone that his counselor-machine is honest or concerned or even relevant?

Now these are severe handicaps and yet they are not the worst things about Imitation #2 when applied to counseling. Foremost among the difficulties with Imitation #2 is its assumption that the things a human being does when he counsels are essential to the notion of counseling itself. This is not necessarily the case and we miss the opportunity to consider what is essential when we accept this form of imitation as appropriate. To see what we mean here, consider a mountain climber. In preparing to climb a good-sized mountain, he will, of course, pack a lot of things in his knapsack including a supply of food. Food is a very important thing on a climb of long duration, but we must be clear about the reason for this. Food is important when you climb a mountain not because it is in any way essential to the notion of mountain climbing, but precisely because human beings climb mountains and human beings must eat at regular intervals. If we build a robot to climb a mountain, no food would be needed.

It may be the same with counseling. Perhaps things like honesty are important in counseling only when human beings counsel. It may be that such things are irrelevant to counseling by machine. Imitation #2 does not allow for this possibility and thus gives up the chance we get by the use of the word "machine" to consider what behavior is or is not essential to our view of counseling. The perspective we gain by our question we would therefore have to give up with Imitation #2. On this ground, as well as on the basis of its other weaknesses, we discard Imitation #2.

Neither kind of imitation will do, it seems, and the expectation that our question can be answered through an imitation game like Turing's must be abandoned. In saying this, we seem to do nothing more than confirm the suspicions the reader must have had at the onset, that the question, "Can a machine counsel?" is a strange and fruitless one to pose. But we do not give up the enterprise because we discard Turing's approach. Indeed, we learn a very important thing from our consideration of the imitation game—a fact which helps us construe our question properly. This is that *all our difficulties with both kinds of imitation stem from the assumption that a machine can counsel only if it can mimic a human counselor*. If we think of our question in a different way—one in which, although we maintain the notion of imitation, we need not expect a machine to ape a counselor—then we can proceed without running such a risk of heresy.

The idea that "imitation" need not mean "copying" is not new. Aristotle, for instance, begins his *Poetics* with a consideration of imitation and Oates and O'Neill tell us, he "is seeking to give a secondary meaning to the term." They say that Aristotle uses the word to mean the process which takes place when an artist creates his work of art. "It is through mimesis [imitation], that form comes to be imposed upon the artist's material broadly conceived," (1938, p. xxiii). That which art imitates is nature, or more accurately, the *process* of nature; and even though the objects of nature are natural and the objects of art are artificial, these objects of art "are produced as nature would have produced them" (McKeon, 1947, p. 621). Art imitates nature in the processes of production as well as in the objects produced.

The difference between art and nature to Aristotle rests in the difference between internal and external causation. He considers nature to be "a cause of motion internal to the thing moved, while art is an external cause employed by the artist to impose on matter a form first conceived in his mind" (McKeon, 1947, p. 621). This distinction is important to our purpose because it is in the play between the internal and the external imposition of form that we can begin to characterize our beliefs about the act of counseling and thus the role, if any, a machine can have in this act.

The artist wishes his audience to undergo an experience and as a result to become more sensitive not to the objects of art themselves but to the natural phenomena which the process of their creation mirrors. The artist differs from others not so much because he can draw or sculpt or write the language well, but because he can experience in a natural phenomenon that which the rest of us can experience only through his artistic expression of that phenomenon. Thus the artistic process—the imitation—is a way of experiencing the world and the object of art is an effort to communicate this experience.

## ARTISTRY AND COUNSELING

But this meaning of "imitation" can be used also we feel to describe generally the act of counseling, and the mission of the counselor can be thought of as much like that of the artist. The counselor's material is his client's predicament and the manner in which he establishes and develops the relationship between the client and himself and their subsequent creation together of the basis for resolution of this predicament constitute the counselor's mode of imitation. The counselor's intent is not merely the resolution of difficulty, but rather the revelation of the *process* by which such resolution becomes possible. He accomplishes this through a kind of enactment where form comes to be imposed upon the client's predicament first by the counselor's external representation of the process of resolution, but eventually, through insight, by the client's internal experiencing of the process.

This internalization is the goal the counselor seeks to reach through the essentially artistic activity of revealing, by way of the counseling relationship, the process of resolution. Should the relationship become more important to either of them, then the counselor has failed just as the sculptor fails if his model of Man obscures the experiencing of men from which the sculpting stems.

Now, what all of this means, of course, is that counselors are themselves imitators. When we wonder if a machine can counsel, therefore, we will confuse the issue by expecting the machine to mimic the human counselor because in expecting this we forget that a human being is one kind of medium and a machine is another kind of medium. Because machines and human beings are different media, to expect one to act like the other is much like expecting a poet literally to paint a portrait with words. We must let the machine stay a machine, but recognize that the activity of counseling by human beings is a means to an end, this end being some desired condition in which the client will eventually find himself. Our interest thus centers on the possibilities of a machine achieving this same end even though it does so in a manner clearly different from human beings.

In this way we come to the heart of the question, "Can a machine counsel?" By it we mean to ask: *is it possible to create a machine environment such that an individual who functions in certain specifiable ways within this environment can be said to* *have been counseled?* We do not ask if a machine can copy what human beings do when they counsel, but rather if we can achieve an identity of goals between a counselor and a machine.

## THE GOALS OF COUNSELING

Having settled on this meaning of the question—and thus gained the perspective we need—we are faced with the problem of answering it. To deal with this problem we will first consider what it is a machine must accomplish (notice we do not say what it must *do*") for the answer to our question to be "yes." That is, the primary concern here must be with the *basis* on which the question is to be answered. Following this we can assess the possibilities that such a machine can exist.

Since we pose the question in order to gain perspective on our beliefs about what counseling is, we will at this point present these beliefs although we will be general about it and hardly as explicit as might be desirable. Notice, however. that even though we speak about a particular idea of counseling, the approach to the question is not bound to any specific technique or form of counseling. As a way of viewing the problem, it is general. Thus we recognize the diversity of opinion that can be tolerated within this approach and we offer one notion of counseling not to argue its merits here but to provide a case in point from which to evolve a basis for an answer to our question.

Counselors, we assert, deal with problems of a particular kind in the manner generally proposed earlier. That is, they deal with these problems by concerning themselves, and hopefully the client, with the processes by which such problems in general may be resolved. In this way some specific problems and the resultant condition in which it leaves the counselee are used by the counselor as the material with which to fashion an understanding of the process of problem-solving. This, of course, is the reason why the giving of advice is not enough by itself to amount to counseling.

Now to be more specific about this, we argue that you should send a person to a counselor, instead of some other kind of psychologist, when that person has a problem[2] related to his career. The word "career" and the word "problem" are two poor choices of words because in their meanings in ordinary language they do not say all we intend to say. Usually, "career" is used in a far too limited way and "problem" in a far too general way to suit our needs here; but they both, nonetheless, contain the grains of meaning we seek. A brief explanation of our intentions with these two words will clarify the situation.

By "career" we do not mean just a person's job, or occupation, or vocation, or even his life's work. These are all parts of our meaning, of course, but we include much more. In saying that we include more, however, we do not mean to suggest that a career is something that is pieced together or that it is in fact definable by whatever may be included in it, anymore than we would say that the motion of a motion picture is definable in terms of the frames that make up the film or anymore than we would think of electrical current as the piecing together of electrons. Motion and flow are not inherent in the objects that move or the liquids that flow, but rather they are the impressions that moving and flowing things leave behind. Thus while motion, for instance, may be implied by objects that move, it is not in the strictest sense made up of those objects.

In this sense career is like motion. We view career—and this is not a very new idea—as the time extended working out of self. This working out of self provides the context and the opportunity for the "expression of hope and desire and limitation upon life" (Tiedeman and O'Hara, 1963, p. iv). By the working out of self, the continuity we call career is created and while purposive behavior is central to the process, we do not consider career strictly as a road that *leads* somewhere. It is, instead, a trace of much the same kind as the bread path of Hansel and Gretel. *Career is the consequence of passage.*

Now the mechanism for this working out of self, and thus for the inscription of career, is the activity of deciding and this leads to our meaning of the word "problem." By "problem" we mean some difficulty with deciding. The reason deciding is so important to the process is that it is by the exercise of individual freedom through choice that career becomes the mapping of self instead of just a smoke trail. One difficulty with deciding a person might have is the lack of ability to decide: he may not know how to decide. A second difficulty might be that he is not aware of the nature of the decision to be made. Perhaps the most general difficulty a person can have—one for which a counselor is most needed is the inadequate sense that one *can* decide. At the base of much trouble people have with deciding is the absence of a clear sense that a person can be an agent in determining what happens in his life. Later, we will say more of this sense of agency and its relation to the development of self.

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[2] We use the strong word "problem" here even though we consider that a problem is not the only thing that can be an appropriate motivation for seeking counsel. Curiosity, for example, may well be equally appropriate as may be the kind of involvement an individual experiences when in a game-playing mode.

The specifics of the process of decision-making may be characterized by way of a paradigm proposed in 1963 by Tiedeman and O'Hara. In confining the paradigm to the rational form of decision-making they state: "It seems sufficient to suggest a paradigm of the process of reaching a rational decision since such is the differentiated and later integrated condition that the practices of guidance attempt to facilitate." (p. 38) It is through the notion of decision-making as depicted in this paradigm that we will view the counselor's effort to impose form on the client's predicament and thus to reveal the processes by which the imposition of such form can be generally achieved.

According to the paradigm, the process of decision-making is divided first into two aspects called *anticipation* and *accommodation.* The anticipation aspect consists essentially of a person's preoccupation with the pieces—facts, alternatives, options, consequences—out of which a decision is to be fashioned and with the aspirations, hopes, expectations, constraints, and the like which will determine the form of the decision. The accommodation aspect—also called "the aspect of implementation or adjustment"—represents the movement from anticipation to induction; it is the point where imagination meets reality. In the case of both anticipation and accommodation it is possible to speak about "subaspects" or stages.

The first stage of anticipation, called exploration, begins with a person's awareness "that a problem does or will exist and that a decision must be reached in order to resolve it in a satisfying manner" (p. 38). In discussing exploration, Tiedeman and O'Hara state:

> In the step of exploration . . . a number of different alternatives or possible goals . . . may be considered. Revelant goals are those which can possibly be attained from the opportunities associated with the problem under consideration. . . . During the exploratory step fields are relatively transitory, highly imaginary (perhaps even fantastic), and not necessarily related one to the other. They may be a relatively unassociated set of possibilities and consequences. . . . In the step of exploration in relation to a problem of career development, a person probably reflects at least upon his aspiration, opportunity both now and in the future, interest, capability, distasteful requirements that still can be tolerated, and societal context for himself and his dependents. These are relevant aspects of the field set by each goal. In short, a person attempts to take the measure of himself in relation to each alternative as he senses it. (pp. 38 & 41)

Of *crystallization,* the second stage of anticipation, they assert:

> In [crystallization] the cost of the several goals can be considered in relation to the return from each. The value of alternatives can then be assessed. Relevant considerations are organized or ordered in this process of valuing. . . . The process of valuing gives rise to values which tend to fix the organization or order of all relevant considerations in relation to each of the goals as crystallization occurs. . . . Crystallization normally represents a stabilization of thought. A setting of thought is achieved which is ordinarily of some durability and hence of some reliance. This set readies the person for investment of self along a line that then becomes more noticeable. The situation becomes defined, so to speak, at least for a time (p. 41)

The third stage is that of choice and it follows readily on the heels of crystallization. Quoting again from Tiedeman and O'Hara:

> With *choice*, a particular goal, and its relevant field . . . orients the behavioral system of the person of relevance for his problem. . . . This goal may be elected with varying degrees of certainty and its motive power will vary as a result. . . . Furthermore, the degrees of clarity, complexity, and freedom generally available to the person in the solution of this problem and in the pursuit of the indicated decision will also affect the motivating power of the resulting resolution of alternatives. (p. 42)

The fourth and final stage of anticipation is called *clarification*. You would expect that once a choice had been made that aspects of decision-making which precedes action would have been finished. But even though the decision is made and held firmly, often doubt about the decision will arise. This is true

> . . . in even a short period of waiting (a week or more, say) for the expected situation to begin to unfold . . . doubt experienced in the waiting period causes the individual further to clarify his anticipated position. An elaboration and perfection of the image of the future . . . ensues. . . . *Clarification* not only perfects the image of self in position, but also dissipates some of the former doubts concerning the decision. (p. 43)

The three stages of accommodation may be briefly described in the following way:

> *Induction:* . . . A general defense of self and a giving up of an aspect of self to group purpose; . . . the individual's goal and field assimilatively become a part of the region . . . of the social system in which the person is implementing his desired solution of his problem. He learns the premises and structures-in-interaction required for continued identification. This process leads to a further perfection of individual goal and field in the social system. . . .
>
> *Reformation:* . . . The receptive orientation of induction [*gives*] . . . way to [*an*] assertive orientation. . . . The person is well immersed in a relevant group. . . . He has a strong sense of self and actively enjoins the group to do better. . . . Since . . . the

> person acts both upon the in-group goal and field . . . in order to bring that group into greater conformance with his modified goal and field . . . and upon the out-group to bring their view of his identification into greater consistency with his, the effect, if any, is the modification of group goal and field . . .
>
> *Integration:* Synthesis is, of course, the essence of integration . . . A differentiation in identification has been achieved. The new-found appreciation of self is integrated with its larger field. This new part of the self-system becomes a working member of the whole self-system. In integration, individual and group both strive to keep the resulting organization of collaborative activity. . . . The individual is satisfied, at least temporarily, when integration occurs. (p. 44)

Now there is something peculiar about this paradigm; a potential difficulty quite similar to the problems we sometimes get into when we use language. A peculiarity of language known to philosophers for some time is that among the things we use language to talk about is language itself. Bertrand Russell, for example, had shown that it is a case of bad "philosophical syntax" to assert something like, "The golden mountain does not exist," and from that suppose you are attributing some kind of existence to the very thing whose existence is denied in the sentence. As language does sometimes, the paradigm of decision-making turns back onto itself in a way we must be clear about. Not only does the paradigm depict the decision process, it also by this depiction, prescribes how one should relate to that process. That is in enunciating the aspect of accommodation, the paradigm argues that one of the things to which one must accommodate is the decision process itself. But integration is the development of meaning that is independent of language as the instrument of that meaning. Thus, the language of decision-making, even though it is the medium through which understanding of the process comes, must be thrown off before the accommodation is complete.

This throwing off—perhaps making invisible is a better thing to say—of the instrument of meaning gets us back to the play between the external and the internal imposition of form we spoke of earlier. Accommodation to decision-making itself is the most general kind since it represents internalization of the *processes* of resolution. First the language must be established for the individual (induction), then it must itself become an object of analysis (reformation), and finally it must dissolve, as the individual goes past it to meaning (integration).

By way of the essentially artistic activity described earlier, the counselor must take his client through these phases, not with respect to a particular problem so much as with respect to the process itself. He must establish the client's proficiency in the language of the process, develop his awareness of this language and its effects, and, in the end, facilitate the individual's internalization of this process. In doing this, we argue that the counselor leaves the client with a sense of agency as a logical consequence. The state in which one believes himself to be a significant agent in determining what happens to him comes not from convincing him about it but from the internalization of the decision process.

## RECONSIDERATION OF THE QUESTION

Having said all of this—briefly and with hardly enough explanation—about our views of counseling we can now pursue the terms under which an answer to the question we pose in this paper might reasonably be formulated. In the most general sense, before we would be willing to say that a person has been counseled by machine, this machine would have to accomplish at least three things. First it would have to reflect the elements of decision-making in such a way that the language of the process was exposed to the client. Naturally this exposure of the language must lead to the development of the individual's proficiency in its use. Second, the machine must encourage the development of awareness of the process and the relation of self to problems as viewed by that process. That is, the process must become a mechanism for the manipulation of this relationship between self and predicament. Finally, the machine must allow and foster the individual's accommodation to the decision process both in terms of specific predicament and, more important, in terms of the process in general. Remember, because we seek *identity of goals* between machine and counselor we need not expect this act of counseling to be carried out the same way by each.

But this is easy enough to say and, even though the idea of identity of goals enhances our perspective and subsequent analysis, we have no reason yet to suppose that a machine can accomplish anything resembling what we need. To repeat the point we made in the first paragraph, however, we really do not have to bother with what it would take specifically for a machine to counsel. What we are hoping for with this argument is that the reader will be encouraged to ask our question about his view of counseling. In our case we should go back and examine the many roads we have opened for ourselves. We should wonder, for instance, what a human counselor can do to achieve the ends of counseling as they have emerged from our attempt at the question. Are certain techniques more defensible than others? Are the honesty or the concern or the objectivity of a counselor important techniques or essential conditions of counseling? Are there pedagogical issues central to the achievement of the goals of counseling?

Even though such questions must be dealt with carefully and fully before we will know enough to talk in any but a superficial way about machines and counseling we will nonetheless attempt an answer here. For two other reasons, the answer will be bad. First it will be an answer by example which is the coward's way out. Second, it is a weak example. But some of our previous argument will at least be clarified by this attempt at an answer.

There is an old oriental saying that if a man has one hundred miles to walk, he is wise to consider himself half way there only when he has walked ninety miles of the journey. By such reckoning our example is hardly more than a glance in the direction we wish to go. For our example we describe the ISVD project as it exists after only about two years of work on it.

As has been noted earlier, the theory underlying the ISVD project deliberately plays upon a potentially useful distinction between *data* (facts) and *information* (facts interpreted in relation to use). The task of the information system is to enable the individual to transform data into information. This is to be done by teaching him to interpret the data in the light of his own knowledge, experience, and intention, so that his organization and use of the data represents his own personal relationship to them in the process of decision-making. We presume that only when data are used in this way can they be described as information where the individual is concerned. The information so generated can then, in turn, serve as data in the making of future decisions. Given that the quality of decisions is directly related to the kind, quality, and comprehensiveness of the *information* (i.e., data in relation to personal intention) considered by the individual during the process of decision-making, then a fundamental task of guidance is to identify, evaluate, and classify needed data *and to make them readily available to students in usable forms and at needed times and places.*

Throughout the individual's passage from point to point in the decision-making process, he continues to engage in the act of turning data into information. This is a major concern of the project, since, in the real world, data are never complete and neither is information. Often, it is precisely this incompleteness that makes decisions necessary in the first place. In any event, the quality of the choice depends upon the quality of the data. Before one attempts to make a decision, therefore, he must first understand the incompleteness of the data and information with which he is dealing.

Accepting data and information on these terms leads naturally to the condition that one is more likely to take responsibility for the choices he makes, since they are not totally determined by external factors. If they were, then choice would be either irrelevant or superfluous. Furthermore, in order to create information on which to base decision, one must actively process data rather than passively be guided by them, and therefore, the individual must become a significant agent in the choice process. That is, the incompleteness of data implies that the individual is *responsible* for his decisions in both meanings of the word: he is the one who makes the decisions, not someone or something external to him; he is the one who enjoys or suffers the consequences. This is one way to define "freedom" and it is to this notion that the project is dedicated. It will achieve this goal by developing in the student the ability to engage in this kind of decision-making relative to his career choice. That is, the project will place the student among resources, enhance his access to them, teach him the stages in decision-making, and have him engage the resources in a controlled setting so that he can develop the skills of processing data and making decisions.

An additional factor in the decision-making procedure which this project proposes is called *monitoring* and consists in keeping track of the student as he goes from stage to stage through the paradigm time and again. Aside from the usual reasons for monitoring a student's behavior—to analyze his performance, select from alternate courses of action, and generally maintain an account of his interaction with a system—the project expects to present to him the facts of this monitoring so that he might use them as additional data. These facts become a kind of meta-data which the student processes. The idea of data and meta-data is analogous to the philosophical notion of being and becoming. Not only does the individual act but he becomes aware of his pattern of action. The desired result is a higher order of understanding of both the decision-making act and the panorama of career choice in which decision points are linked. Career becomes a time-extended set of choices, and decision at any given point is enhanced by an overall awareness of the road being travelled.

What the project proposes, then, is a model of decision-making behavior which requires a setting capable of providing feedback and of generating feedforward, the individual's feedforward, that is. It is an interactive setting in which an individual engages one or more data files in certain specifiable ways as a means of determining alternatives and of selecting from among them on bases understood to himself.

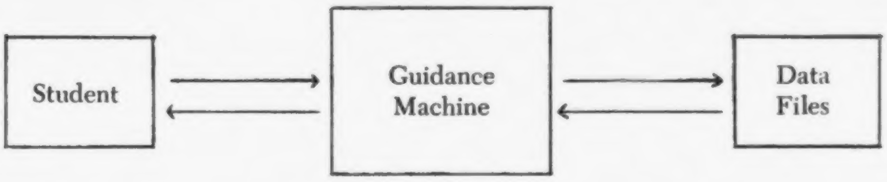
The setting we seek is one which will develop in the student the ability to engage in the decision process as depicted by the paradigm described earlier. Some of us call this setting a reckoning environment because we want students to do more than just make up their minds. We want them to figure up, measure, estimate, compare, judge, make calculated guesses, and in the end decide *and* take responsibility for their decisions. This, of course, is what "deciding" means, but often people equate decision-making with choice-making and thereby miss the inherent notion of the process and its extension over time. What is left, usually, is the mistaken idea that a person decides by making up his mind, and thus we hear about the moment of decision as though it all happens at a point in time which is discrete and unbounded by thought and reflection. To make it clear that it is precisely this misconception and the resulting inflexibility we wish to challenge in ISVD, we have come to refer to *the setting for vocational decision-making which we are creating as a vocational reckoning environment.*

Once we recognize the obvious fact that data and information are never complete it becomes wise—often vital—to place the condition on choice that it be made with the best possible data available. We must ask of the data: Are they *accurate*? How *complete* are they? Do they reflect the full *complexity* with which we must deal? Can we get them in *time* to explore alternatives adequately? A library is unsatisfactory in this area, because the time involved in searching is often more than the individual can afford. Certainly large amounts of data—occupational descriptions, for example—can be stored, indexed, cross-referenced, and made generally available in a library, but that is only part of what is needed. The computer, on the other hand, is capable of all this and of providing fast access so that search time need not hamper decision-making. Furthermore, the computer can interact with the student and thereby help him to ask relevant questions about the world of work. The project looks to the computer, therefore, as a device to store large amounts of occupational data and to make them immediately and selectively available to the individual as he proceeds through the decision-making process. With this kind of accessibility, the individual can feel he is among resources and as he becomes more integrated into the reckoning environment, the data become more like extensions of him and less like external qualities, that is, they move toward becoming information.

Along with the student himself there are two additional components within the ISVD reckoning environment. The first of these is an extensive collection of data about the world of work, military service, and education. Facts about jobs, colleges, trade schools, military specialties, and about the student himself are just a few of the types of data to be stored and made available to him. These data are organized into five major data files: occupational, military, educational, personal and family living, and student characteristics. Naturally while each of these files is separate from the other, they all reference each other so that a student may follow a question through all its aspects.

Between the student and the data we intend to place a guidance machine. The function of this third and final element of the ISVD reckoning environment is to facilitate student's access to data and vice versa. That is, not only do we wish to provide a means for the student to gain convenient access to data, but we wish to keep track of such access as well. In this way, not only can an individual get facts with which to make decisions, but he can also gain a sense of the way he goes about making decisions.

One way to describe the ISVD reckoning environment is shown in this diagram.



We in ISVD call our machine a guidance machine and we will use this term for the rest of this paper even though our intention here is to suggest that its behavior approaches counseling.

Now, it is the purpose of ISVD to create a sufficiently explicit description of the behavior of a guidance machine so that a computer can behave as though it were that machine. Our efforts to create a description of a guidance machine fall into two categories. The first is the development of "Necessary Software." This consists of a fairly elaborate set of computer programs which permits certain basic and generally required functions to be performed. We need, for example, to operate in a time-shared setting so that more than one student can use the system at any one time. Furthermore, we must provide the ability to create, maintain, edit, and retrieve data files. A programming language to allow both string manipulation and list processing, programs for statistical analyses, routines to permit content analysis, and the general facility of keeping track of who is on the system and what needs to be done next are some other examples of the kind of Necessary Computer Software with which we must be concerned.

The second category, and perhaps the most interesting one, is the development of ISVD software. These are the programs that enable our time-shared computer to behave like a guidance machine, and it is here that any substantive contributions of ISVD rest.

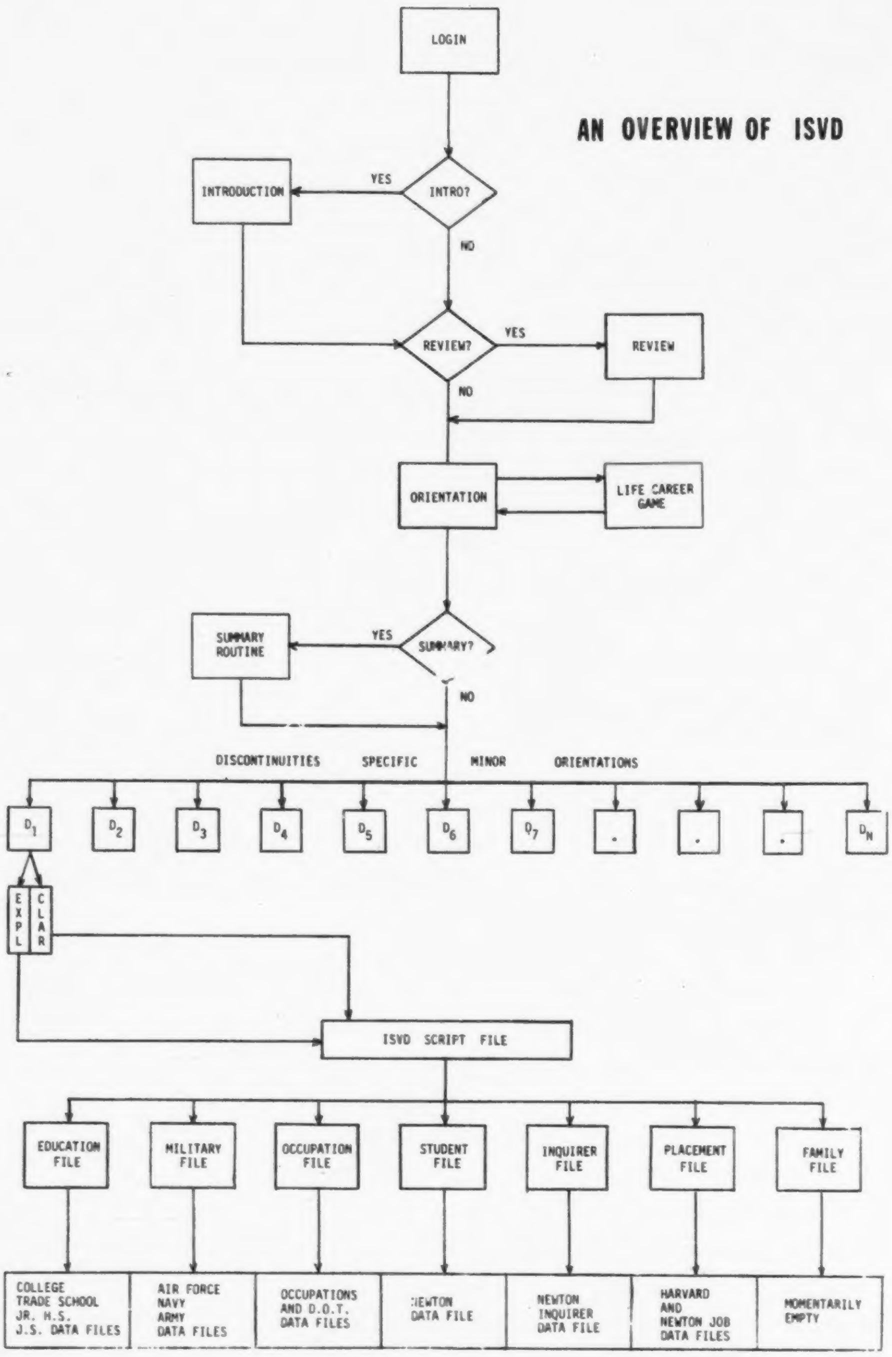
The chart on the following page depicts in a general and incomplete way the overall organization of the ISVD software. This software may be divided into four parts each of which plays a role in the student's development of a sense for the decision process.

The first of these parts consists of the ISVD data files. In the chart these data are represented in the last two lines. Thirteen such data files are included thus far, and our plan is to increase this number as time goes on.

Even though the thirteen data files that are presently going into ISVD are different from each other in a number of respects, they are essentially alike in overall structure. A brief description of one of the data files, therefore, will provide an indication of what the rest are like. The one we will describe is the occupations data file.

The occupations data file contains about fifty facts on each of about eight hundred and fifty occupations. These facts relate to such things as wages, education, physical demands, worker traits, high school courses needed, and the like. The fifty or so facts about each occupation are grouped together to form a record. We call these level-zero records and, of course, there is one level-zero record for each occupation.

In addition to these records, we have made provision for including hierarchical records—level-one, level-two, and so forth—which may be thought of as summary records. The level-one records in the occupations data file, for instance, are used to represent simultaneously many different *logical* organizations of the



**AN OVERVIEW OF ISVD**

LOGIN
INTRO?
YES
INTRODUCTION
NO
REVIEW?
YES
REVIEW
NO
ORIENTATION
LIFE CAREER GAME
SUMMARY?
YES
SUMMARY ROUTINE
NO
DISCONTINUITIES SPECIFIC MINOR ORIENTATIONS
D1
D2
D3
D4
D5
D6
D7
.
.
.
DN
EXPL
CLAR
ISVD SCRIPT FILE
EDUCATION FILE
MILITARY FILE
OCCUPATION FILE
STUDENT FILE
INQUIRER FILE
PLACEMENT FILE
FAMILY FILE
COLLEGE TRADE SCHOOL JR. H.S. J.S. DATA FILES
AIR FORCE NAVY ARMY DATA FILES
OCCUPATIONS AND D.O.T. DATA FILES
NEWTON DATA FILE
NEWTON INQUIRER DATA FILE
HARVARD AND NEWTON JOB DATA FILES
MOMENTARILY EMPTY

data without concern for their *physical* organization. One set of such records might be used to characterize the records in terms of the Roe categories while another set might represent someone else's taxonomy.

Besides these two kinds of records, the occupations data file contains a fairly extensive collection of incomplete, but completable, English sentences of the form, "The salary of X is Y," or "To be an X requires Y years of education." If a student should ask something like, "How much do doctors earn?" or "How long do I have to go to school to become a plumber?" then the variables X and Y in these template sentences would be replaced by the appropriate facts and presented to the student. The use of these template sentences—and paragraphs—need not be as trivial as the example offered here.

The version of ISVD described in this sub-section—called Prototype I—contains in its thirteen data files several million data potentially relevant to career choice. This part of the ISVD software, while in no sense, complete, is nonetheless sufficiently extensive to allow non-trivial exploration.

As extensive as these data are, however, the single, most significant component of ISVD software is that network of routines we call *scripts*. Not unlike the manuscript of a play (from which it was given its name) a script is a set of rules describing how the guidance machine is to act. Scripts contain such things as the text to be presented to a student via either a video display device or a printer, commands to activate a tape recorder, or motion picture projector or to display a 35mm slide, instructions for how to process the student's responses, and rules for any computation or storage or retrieval of data.

Some scripts deal with the concepts underlying the decision process and are called teaching scripts. These scripts superficially resemble the usual computer-aided-instruction material. Preference scripts are a second kind. They are used to assist the student in his consideration of the factors on which choice may be based. The taking of a preference script has the effect of processing the associated data file, leaving behind only those records that conform to the stated preferences. Finally direct access scripts are used to retrieve specific bits of data from the files.

A third part of the ISVD software is called the Access Routine. EXPLORATION, CLARIFICATION, and REVIEW Access Routines serve to engage the student in behavior representative of the decision paradigm. They are used like filters between the student and his access to data and in this way are supposed to develop his proficiency and his awareness of the decision process. In Access Routines must rest the artistry which is inherently that of counseling.

To show what we mean here we will give an example of how an Access Routine works. The example deals with the discontinuity of college choice; and even though this excerpt is an actual interchange between individual and a computer, we do not wish to give the impression that this program functions perfectly or even well enough to be impressive. To us it has been nothing more than a test case. [Note: In all sample interactions, the computer's output is uppercase and the student's input is upper and lowercase.]

WHAT WOULD YOU LIKE TO DO TODAY.

I want to think about colleges to apply to next year.

SINCE WE KNOW THAT YOU HAVE NOT EXPLORED YOUR COLLEGE CHOICE WITH THE SYSTEM BEFORE, THE FIRST THING WE WOULD LIKE TO FIND OUT IS IF YOU HAVE THOUGHT ABOUT THIS CHOICE ENOUGH TO HAVE SOME ALTERNATIVES IN MIND. IF YOU DO, TYPE THE NAMES OF EACH OF THE ALTERNATIVE COLLEGES. IF NOT, TYPE IN THE WORD NO.

Harvard University, Boston College, Berkeley.

GOOD. WHAT KINDS OF THINGS DID YOU DO IN EXPLORING COLLEGE CHOICE. DID YOU READ ANY COLLEGE CATALOGUES OR TALK WITH YOUR GUIDANCE COUNSELOR. MAKE AS COMPLETE A STATEMENT AS POSSIBLE.

I read the catalogue for Harvard and Boston College. I talked with my guidance counselor, and had a couple of interviews with the Dean at Harvard. My father went to Berkeley so that's why I'm interested in going there.

THESE ARE THE ACTIVITIES THE MACHINE HAS RECOGNIZED OR ANALYZED FROM YOUR STATEMENT. YOU HAVE DISCUSSED THE MATTER WITH MEMBERS OF THE FAMILY, SPOKEN WITH A GUIDANCE COUNSELOR, READ SOME COLLEGE CATALOGUES, SPOKEN WITH COLLEGE OFFICIALS. HERE ARE SOME OTHER THINGS THAT MAY BE A GOOD IDEA TO DO IF YOU HAVEN'T ALREADY. YOU COULD HAVE DISCUSSED THE MATTER WITH A TEACHER. NOW THEN, LOOK AT THE LIST OF EXPLORATION ACTIVITIES THAT YOU PERFORMED OUTSIDE OF THE SYSTEM. HERE IS THE LIST OF YOUR PRESENT ALTERNATIVES.
HARVARD UNIVERSITY, BOSTON COLLEGE, AND BERKELEY. NOW TYPE IN THE ACTIVITIES THAT YOU FEEL HELPED YOU MOST ABOUT MAKING UP YOUR MIND OR GAVE YOU SOME ALTERNATIVE COLLEGES TO THINK ABOUT. PLEASE TYPE THEM IN ORDER OF IMPORTANCE.

The interviews and talking with my dad.

GOOD. BEFORE WE GO ON TO EXPLORE COLLEGE CHOICE, WHAT ARE THE FACTORS THAT YOU THINK ARE IMPORTANT IN CONSIDERING WHICH COLLEGES TO APPLY TO.

Grades, class rank.

ANYTHING ELSE.

Tuition costs, test scores.

HERE ARE SOME OF THE FACTORS THAT OTHER STUDENTS FOUND IMPORTANT (1) CURRICULUM CHOICE (2) COURSE SELECTION (HIGH SCHOOL SUBJECTS) (3) GRADES (4) CLASS RANK (5) TEST SCORES (PSAT, SAT, CEEB, ACT) (6) EXTRA-CURRICULAR ACTIVITIES (7) FUTURE VOCATIONAL PLANS (8) GOAL IN GOING TO COLLEGE (9) POST COLLEGE EDUCATION AND/OR TRAINING.
HERE IS YOUR LIST.
GRADES, CLASS RANK, TUITION COSTS, TEST SCORES. LOOK AT BOTH LISTS AND THEN TYPE IN ALL FACTORS FROM BOTH LISTS THAT YOU CONSIDER IMPORTANT IN THINKING ABOUT COLLEGE CHOICE.

High school courses, grades, class rank, test scores, tuition costs, future vocational plans.

FINE. THERE ARE SEVERAL WAYS THAT YOU CAN GO ABOUT THINKING ABOUT COLLEGE CHOICE WITHIN THE ISVD SYSTEM.
YOU CAN GO THROUGH SOME CONCEPT SCRIPTS WHICH ARE DESIGNED TO GIVE YOU SOME FACTS ON TOPICS RELEVANT TO COLLEGE CHOICE. OR YOU CAN PLAY THE LIFE CAREER GAME. USING THE DATA OF A MAKE BELIEVE STUDENT WHO IS LIKE YOU IN SOME WAYS, YOU GO THROUGH THE PROCESS OF SELECTING A COLLEGE FOR HIM.

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IF YOU HAVE SPECIFIC COLLEGES IN MIND, YOU CAN GET DATA ON
THEM BY ACCESSING THE EDUCATION DATA FILE.
IF YOU LIKE, YOU CAN LET THE SYSTEM GUIDE YOU THROUGH A
STATEMENT OF PREFERENCES TO COME UP WITH A LIST OF COLLEGES
THAT MOST NEARLY MATCHES YOUR PREFERENCES. OR YOU CAN
ELECT TO FIRST GO THROUGH A UNIT ON DECISION-MAKING, A UNIT
THAT TRIES TO HELP YOU UNDERSTAND YOURSELF AND OTHERS IN
RELATION TO MAKING DECISIONS.
WHAT WOULD YOU LIKE TO DO.

Access the education data file.

YOU HAVE ACCESSED THE EDUCATION DATA FILE. FOR DEMONSTRA-
TION PURPOSES ONLY, THE FOLLOWING SCHOOLS HAVE BEEN IMPLE-
MENTED. HARVARD COLLEGE (MEN), GOUCHER COLLEGE (WOMEN),
BERKELEY UNIVERSITY (LARGE STATE SUPPORTED SCHOOL), BOSTON
COLLEGE.(RELIGIOUSLY AFFILIATED), AND CARNEGIE INSTITUTE (TECH-
NICAL TRAINING SCHOOL). THE FOLLOWING FOUR VARIABLES HAVE
BEEN IMPLEMENTED . . . COSTS (INCLUDING TUITION, ROOM AND
BOARD, AND OTHER FEES), REQUIRED ENTRANCE EXAMS, CRITERIA
USED IN SELECTING STUDENTS AND REQUIRED HIGH SCHOOL COURSES.
NOW THEN YOU CAN QUERY THIS MICRO DATA BASE IN ANY WAY
THAT YOU WANT. PLEASE DO NOT USE QUESTION MARKS. IF YOU
WISH TO STOP AT ANY TIME, TYPE IN THE WORD STOP.
YOU MAY BEGIN.

How much does it cost to go to Harvard.

TUITION AT HARVARD IS 2000 PER YEAR INCLUDING LAB AND HEALTH
FEES. ROOM AND BOARD IS 1170 DOLLARS. NON-RESIDENT STUDENT
FEE IS 25 DOLLARS. BOOKS AND SUPPLIES ABOUT 70 PER YEAR. PER-
SONAL EXPENSES ABOUT 375 DOLLARS INCLUDING ROOM SUPPLIES,
CLOTHING, CLEANING AND LAUNDRY, RECREATION, AND OTHER PER-
SONAL EXPENSES (EXCEPT TRAVEL).

How does that compare with Boston College.

BOSTON COLLEGE'S TUITION IS 1600, ROOM AND BOARD IS 1050
DOLLARS. OTHER COSTS INCLUDE BOOKS AND SUPPLIES ABOUT 100
DOLLARS, LAB FEE 100 DOLLARS AND 30 DOLLARS FOR WOMEN BOARD-
ING STUDENTS FOR HEALTH FEES.

What high school courses should I take for Boston College.

NO SPECIFIC NUMBER OF UNITS IS REQUIRED HOWEVER THE FOLLOW-
ING MINIMUM IS REQUIRED. ENGLISH (4), ALGEBRA (2), PLANE GEOM-
ETRY (1), FOREIGN LANGUAGE (2), TRIGONOMETRY (1/2) (FOR STUDENTS
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PLANNING TO MAJOR IN MATH, BIOLOGY, CHEMISTRY, OR PHYSICS), BIOLOGY, CHEMISTRY, OR PHYSICS (2) (FOR STUDENTS PLANNING TO MAJOR IN THE ABOVE SCIENCES AND FOR APPLICANTS TO THE SCHOOL OF NURSING), ACADEMIC ELECTIVES (5).

What specific entrance exams are required.

BOSTON COLLEGE REQUIRES THE SAT AND THREE ACHIEVEMENT TESTS. ENGLISH, LEVEL I OR II MATHEMATICS, AND ONE OF THE CANDIDATE'S CHOICE.

Does Berkeley require the SAT.

APPLICANTS WHO ARE INELIGIBLE, DUE TO GRADE AVERAGE, OR TO UNIT OR DISTRIBUTION DEFICIENCIES, OR WHO HAVE GRADUATED FROM AN UNACCREDITED SECONDARY SCHOOL, MAY QUALIFY FOR ADMISSION BY CEEB EXAMINATIONS. THE THREE ACHIEVEMENT TESTS REQUIRED FOR THOSE APPLYING FOR ADMISSION ARE . . . ENGLISH, ONE TEST IN SOCIAL STUDIES OR FOREIGN LANGUAGE, ONE TEST IN MATHEMATICS OR A SCIENCE. REQUIREMENTS FOR CALIFORNIA RESIDENTS . . . TOTAL SAT SCORE OF AT LEAST 1000, AND TOTAL SCORE ON THREE ACH OF AT LEAST 1650 WITH NO SINGLE ACH LESS THAN 500.0. REQUIREMENTS FOR OUT-OF-STATE RESIDENTS . . . TOTAL SAT SCORE OF AT LEAST 1100 AND TOTAL SCORE ON THREE ACH OF AT LEAST 1725.0.

What are the costs there.

TUITION AT BERKELEY IS 980 DOLLARS PER YEAR OF THREE QUARTERS FOR OUT-OF-STATE STUDENTS. NO TUITION FOR CALIFORNIA RESIDENTS. ROOM AND BOARD VARIES BETWEEN 600 AND 940 DOLLARS. INCIDENTAL FEE OF 242 DOLLARS. ASSOCIATED STUDENTS MEMBERSHIP FEE 11 DOLLARS. BOOKS AND SUPPLIES ABOUT 80 TO 110 DOLLARS.

How do they choose their students.

BERKELEY SELECTS ITS CANDIDATES ON THE BASIS OF A CANDIDATE'S SECONDARY SCHOOL RECORD AND CEEB SCORES. ALUMNI RELATIONSHIP AND GEOGRAPHICAL DISTRIBUTION NOT RELEVANT.

How about Harvard.

HARVARD CHOOSES ITS CANDIDATES ON THE FOLLOWING CRITERIA. SECONDARY SCHOOL RECORD, SCHOOL'S RECOMMENDATION, AND CEEB SCORES. ALSO, CHARACTER, PERSONALITY AND EXTRA-CURRICULAR PARTICIPATION ARE STRONGLY EMPHASIZED. SPECIAL TALENTS AND INTERESTS ALSO CONSIDERED.

How much does it cost to go to Goucher.

THERE IS A COMPREHENSIVE FEE OF 2950 DOLLARS PER YEAR INCLUDING TUITION, ROOM AND BOARD, AND LAB FEES. STUDENT ACTIVITY FEE OF 13 DOLLARS, HEALTH FEE 50 DOLLARS, AND GYMNASIUM OUTFIT 27 DOLLARS. OTHER COSTS INCLUDE BOOKS AND SUPPLIES ABOUT 100 DOLLARS.

What kinds of courses should I take.

16 UNITS REQUIRED, THE FOLLOWING RECOMMENDED . . . ENGLISH (4), MATHEMATICS (3), (2 IN ALGEBRA, 1 IN GEOMETRY), ONE FOREIGN LANGUAGE (3), HISTORY (2), LABORATORY SCIENCE (1). THE COMMITTEE ON ADMISSIONS MAY ALLOW ENTRANCE CREDIT FOR WORK IN ELECTIVE SUBJECTS NOT LISTED.

How do they pick their students.

GOUCHER COLLEGE BASES ITS CANDIDATE SELECTION ON THE SECONDARY SCHOOL RECORD, THE SCHOOL'S RECOMMENDATION, AND TEST SCORES. OTHER IMPORTANT FACTORS ARE PERSONAL CHARACTERISTICS, EXTRA-CURRICULAR PARTICIPATION, AND INDIVIDUAL INTERESTS. ALUMNAE RELATIONSHIPS AND GEOGRAPHICAL DISTRIBUTION CONSIDERED.

I think that I would like to stop now.

WOULD YOU LIKE A SUMMARY OF YOUR EXPLORATION OF THE EDUCATION DATA FILE.

Yes.

FINE.
YOU GOT DATA ON THE FOLLOWING VARIABLES FOR HARVARD COLLEGE . . . COSTS, INCLUDING TUITION AND ROOM AND BOARD, HOW THE SCHOOL SELECTS ITS STUDENTS. FOR BOSTON COLLEGE YOU GOT DATA ON THE FOLLOWING VARIABLES . . . COSTS, INCLUDING TUITION AND ROOM AND BOARD, WHAT HIGH SCHOOL COURSES ARE RECOMMENDED OR REQUIRED FOR ENTRANCE, WHAT ADMISSIONS TESTS YOU SHOULD TAKE.
YOU HAVE FOUND OUT ABOUT
WHAT ADMISSIONS TESTS YOU SHOULD TAKE, COSTS, INCLUDING TUITION AND ROOM AND BOARD, HOW THE SCHOOL SELECTS ITS STUDENTS FOR THE UNIVERSITY OF CALIFORNIA AT BERKELEY.
FOR GOUCHER COLLEGE YOU EXPLORED THE DATA ON THE FOLLOWING VARIABLES . . . COSTS, INCLUDING TUITION AND ROOM AND BOARD, WHAT HIGH SCHOOL COURSES ARE RECOMMENDED OR REQUIRED FOR ENTRANCE, HOW THE SCHOOL SELECTS ITS STUDENTS.

YOU DIDN'T EXPLORE THE AVAILABLE DATA ON CARNEGIE INSTITUTE.
NOW THEN. WOULD YOU LIKE TO GO BACK AND FIND OUT ANYTHING MORE ABOUT THESE SCHOOLS.

No.

WOULD YOU LIKE TO GO INTO CLARIFICATION NOW.

Yes.

OF THE FOLLOWING COLLEGES THAT YOU HAVE EXPLORED, WHICH WOULD YOU CONSIDER APPLYING TO.
HARVARD UNIVERSITY, UNIVERSITY OF CALIFORNIA AT BERKELEY, BOSTON COLLEGE, GOUCHER COLLEGE.

Boston College, maybe Berkeley, and Harvard.

ARE THEY LISTED IN ORDER OF PREFERENCE THAT IS, IS YOUR FIRST CHOICE FIRST ETC.

No.

PLEASE TYPE THEM IN ORDER OF PREFERENCE.

Harvard University, Boston College, Berkeley.

YOU HAVE DECIDED TO GO INTO CLARIFICATION CONCERNING YOUR PREFERRED ALTERNATIVE HARVARD UNIVERSITY.
YOU HAVE ACCESSED THE EDUCATION DATA BASE AND GOTTEN SOME OF THE AVAILABLE DATA ON HARVARD UNIVERSITY.
IN EXPLORATION, YOU STATED THAT YOU CONSIDERED THE FOLLOWING TO BE IMPORTANT FACTORS IN CONSIDERING COLLEGE CHOICE . . . GRADES, CLASS RANK, TEST SCORES, COURSES, GOAL.
NOW THEN, YOU SHOULD HAVE A FAIRLY GOOD IDEA OF WHERE YOU STAND IN RELATION TO THESE FACTORS AS WELL AS WHERE STUDENTS ADMITTED TO HARVARD UNIVERSITY STAND. RIGHT.

No.

WOULD YOU LIKE TO GO BACK TO EXPLORATION TO FIND OUT HOW YOU COMPARE WITH HARVARD STUDENTS.

No.

WOULD YOU LIKE TO CHOOSE ANOTHER ACTIVITY.

Sure.

WHAT WOULD YOU LIKE TO DO.

Find out about jobs.

HOW WOULD YOU LIKE TO DO THIS.

I would like to access the occupation data base.

O.K.

The fourth part of the ISVD software consists of those routines that form the backdrop of the system. These elements perform the task of getting the student to the appropriate place in the system. When a student "logs on" the system he is given an introduction should he need one. He is then asked what he wishes to do. The backdrop routines process his answer and determine which discontinuity (in the chart, $D_1$, $D_2$, etc.) he is dealing with. Another routine then determines whether he is in exploration or clarification with respect to this discontinuity and passes him through the appropriate access routine. From there the student will be provided access to the relevant scripts for his situation and these scripts will in turn provide the needed access to the data bases.

This description is an oversimplification, obviously, but it makes the point of how we intend the guidance machine to function. That is, it indicates in a general way how we hope to develop—through scripts—the student's proficiency with the elements of decision-making and—through access routines—the student's awareness of the process underlying these elements. These are two of the three things which we earlier asserted a machine or a human being must accomplish to be said to be counseling.

The third requirement we listed was that the machine must allow and foster the individual's accommodation to the decision process. This, of course, is the heart of the matter.

In our development of the first prototype of ISVD we have dealt with this third requirement least of all. It is clearly the most difficult issue we face, and although we have certain hunches about it, we are not yet as clear as we would like to be. One hunch concerns the monitoring function, and we have already described how we wish to use the monitoring of student interaction with the system as a means to reveal the process and his relation to it.

Another hunch concerns the Life Career Game and other games we plan for the system. The Life Career Game developed by Sarane Boocock (1967) and others allows a person to develop and go through a life plan for any number of fictitious people. By using this game we hope to have the student experience some of the more realistic concomitants of choice. We place the game where we do in the chart to indicate that it is not merely a component of the ISVD system. We think of it as a point of view about the system in general. That is, a student can use the ISVD either for real (with his own interests or someone he pretends to be). The two major gains with the game are the objectivity one has by dealing with someone else's predicaments, and the extension over as much as twenty (simulated) years that the game provides. As strong as these hunches are, however, we do not have enough experience yet to tell much about them.

One small force for accommodation to the system and thus to the decision process it reflects is the ISVD command language. With this simple language a student can take over control of the system flow moving about in the system the way he wishes. This is very much the kind of behavior characteristic of the integration stage of accommodation and in this way we see the *possibility* that one can indeed accommodate to a machine based system and thus to the process embodied by that system. We recognize that this is somewhat of an overstatement, and we would be more careful about it if our intention was to argue that ISVD's guidance machine can indeed counsel. We have no such intention.

We describe ISVD to provide a sense of what ISVD can eventually become rather than of what it is today. Relating to the question of this sub-section, ISVD is not a case in point because it can prove or disprove anything about this question. On the contrary, in this case ISVD would be irrelevant. We describe ISVD to show a little bit of the relationship that exists between a process and its mechanization. It is here that ISVD is significant.

It is, of course, common sense to say that something must be proceduralized before it can be mechanized and the significance of ISVD is that it clarifies what this means. That is, when thinking about whether or not a machine can counsel, do not be deceived into assuming that the thing that must be proceduralized is the *act* of counseling. If you assume this you inherit all the difficulties of Imitation #1 and #2. But if you wonder, instead, what an environment might be like which has the effects of counseling in terms of what one who functions in this setting is thereby encouraged to become, then even if you decide no machine could ever be a part of this environment, you will have been left with a clearer notion of what your concept of counseling demands.

Now everything we have said in our attempt to answer the question, we recognize, is weak on at least two counts. First, of course, our assertions and our analysis of them need much more consideration if they are to become in any sense firm and sturdy. Second, not only is our example a long way from ideal, there may be no ideal to be reached. We have not gone far enough to know for sure if we can go further.

These are important limitations, but even though we have taken the question seriously enough to attempt an answer, our intention is to offer in the question a fresh look at some assumptions about counseling that are rarely challenged. We expect quarrels over our answer because we know it is simple-minded and a bare first attempt. We hope, however, that these quarrels will not discourage you from seeing in our strategy an opportunity to start from scratch with the problem of what counseling is all about and of how machines may enter into the procedures of counseling when the goals of counseling and for the machine are consonant.

# CAN A MACHINE DEVELOP A CAREER? PROCESSES OF EXPLORATION AND COMMITMENT IN CAREER DEVELOPMENT[1]

## PROCEDURALIZATION AND CAREER

As indicated earlier, ISVD is constructed so as to facilitate comprehension of epigenesis as successive differentiation and integration in decision-making development associated with career evolution. The previous sub-section used the general ISVD notion that something can be computerized without fully proceduralizing it beforehand to indicate how a machine can provide a counseling environment. We also there illustrated how opportunity for repeated choice-making about education, occupation, and military service is arranged in ISVD to let a person induce the structure of decision-making procedure which he must introduce into the computerized environment of choice-making if the supposed "machine" of decision-making is to be internalized in the ISVD counseling environment.

ISVD proceduralizes choice-making in order to facilitate an inquirer's gradual generalization of choice-making to an understanding of decision-making both specifically and generally. "Career" is the primary concept in that generalization. Computerization of the concept of career which makes possible the transfer of its proceduralization from the computing environment to the person requires specification of the career concept which is to be computerized and internalized through the person's proceduralization of it in the ISVD counseling environment. We outline that specification in this sub-section.

We again address specification of the concept of career through examination of the general question of this Theory and Design section, namely, "Can a Machine X?" However, since the specific question we address in this sub-section is "Can a machine develop a career?" we employ a strategy different from that used in the previous sub-section. Where in the previous sub-section we avoided effort to specify a procedure which the machine would imitate, in this sub-section we first lay out a procedure which the machine will be programmed to imitate. We do so because the X of our general question is in this section *both* the act of development and the object of career where the X in the prior sub-section was *only* the procedure of counseling. Therefore the task of this section is to lay out the meaning of development and career. However, we do so in ways by which attainment of those understandings by persons will still remain consistent with the environment of counseling specified in the prior sub-section.

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[1] This sub-section is based on Project Report No. 16A, "Can a Machine Develop a Career? A Statement about the Processes of Exploration and Commitment in Career Development" by David V. Tiedeman.

## AN IMITATION CAREER AS INSTRUMENT IN CAREER DEVELOPMENT

### A TIME CHRONOLOGY

A machine is programmed to record the dates on which an individual enters and leaves each event in his work history. If this record was feathered out so that it also gave the hours of particular days on which the person worked as well as their dates, the chronology would more accurately portray the position which the individual gave work in the time use pattern of his life. However, such a record would become more complicated than it has so far been made in vocational psychology. Therefore, we conceive the chronology in its presently limited sense.

The dates which a person worked at each of the several jobs he held in his life when related to the person's advancing age portray aspects of work in which we have only recently become interested, namely the length of time a person stays on a particular job. Presumably, the length of time a person stays on a particular job increases as he grows older. However, technological change is having considerable effect on this fact at the present time. Technological change is also having effect on the number of jobs which a person is likely in the future to record in his chronology.

### A WORK VITA

If we programmed the machine to record the name of the jobs an individual held in each of the periods which he worked as well as the company in which the job was discharged, other matters in vocational psychology spring into being. We think of jobs in terms of their kinds, their responsibilities, and of the companies in which they are practiced. When we think of jobs in terms of their kinds we frequently call those kinds, "occupations." We thus consider occupation to be a more general term than a job. By making reference to the job and enterprise codes of the *Dictionary of Occupational Titles* (1966) stored in its memory, our machine can indicate the occupations at which an individual has worked. Our machine memory will also contain the occupational level codes of Holland (1966) and/or Roe (1956). The machine can therefore write a work vita which incorporates inferences about the level of responsibilities an individual has held and now holds. The memory of the machine will also include Super's (1957) code of enterprise. The program can therefore incorporate in the work vita inferential data about the kinds of work organizations in which the work has been and is performed.

The memory of the machine will also include Roe's (1956) group categorization of occupations. A program will be written based on these group classifications which infer the vocation which a person is pursuing. This program will be based on the consistency of the groups in which the person's occupation falls as he changes work. The program for inferring occupation will also compare the levels of an individual's several jobs as well as their groups. A vocation associated with progress in advancement level will be called a career. Persistent advances in level accompanied by changes in groups and/or enterprises will be referred to a new table which will contain career names different from vocation names based on Roe groups. Records of uniform level with variability in Roe groups will be referred to still another career table to find names appropriate for such records. Records with vacillating levels and groups will be referred to still another type of career table to name the career. Finally, career names associated with employment in the same group at vacillating levels will be obtained from still another type of career table. The machine will also contain a table permitting the inference of interests from the work organizations in which an individual has been employed. This table will particularly differentiate self from company types of employment and in the latter case differentiate work style based on inference about work groups. Inferences about vocation, career, and work style will be further referred to tables from which personality characteristics will be inferred.

## PERSONALITY ORGANIZATION[2] IN THE WORK CHRONOLOGY AND VITA

An individual's naming of his job and the company in which it is practiced can also be referred to the stored *Dictionary of Occupational Titles* for reference to description of its duties and prerogatives, the interpersonal, material, and ideational relationships it requires and permits, and the experiencing style it requires and permits in relation to the experiencing style effected in the non-work environment. Suppose that we consider as structure the three elements in each kind of description, namely 1) requirements and prerogatives, 2) interpersonal, material, and ideational relationships required and permitted, and 3) the experiencing style required and permitted. Furthermore, let us consider the function of aspiration in growth or effective curiosity as we might better conceive growth. Then we can consider as organization in his personality the change from one structure to another which a person attempts and effects as he vocationally responds to aspiration in growth. Although we cannot specify the detail at the moment, let us suppose that we can write programs which infer organization when structures are compared, pair by pair in sequence.

When the vocational history has been programmed sufficiently for organization to exist, it becomes possible to conceive development. What develops in vocation is the organization of occupational structures in service of the aspiration function. What develops in our program of vocational development is the linguistic context within which we explain the vocational aspects of the life history.

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[2] Tiedeman is primarily indebted to Gordon Dudley and Eileen Morley for teaching him about the terms and concepts of organization as used herein.

## EDUCATION AND WORK THE CHRONOLOGY AND VITA

Suppose that the machine is further programmed to record an educational chronology and vita as well as the work chronology and vita. When the work history is joined with an educational chronology and accompanying naming of the educational experiences associated with each of several discrete periods, we must recognize that education is no longer necessarily all concentrated before work. Therefore, two relationships of interest in vocational psychology must be programmed. One relationship which must be programmed is the *interspersing* of education and work. The other relationship which must be programmed is the *interdependence* of education and work. At the present time this interdependence can be either *preparatory* as it has traditionally been or *synergetic* as it may well more frequently become. In the synergetic condition we might well conceive a job as causing a person to know that he must expand his knowledge from education and to act upon both what knowledge he has and that prior fact while continuing in his job.

Some of the aspects of the named educational experience which must be programmed because of their interest in vocational psychology are those associated with 1) the kind of school a person is in during a period, elementary, secondary, tertiary, for instance, and 2) the subjects he studied. The kinds of schools a person attends are programmed to relate with the conception of level in occupation. The Cooley and Lohnes (1968) career tree will be helpful in the preparation of this program. However, in broader outline, the subjects a person pursues are programmed to bear both on level in one sense but on kind of occupation in a more important sense. It is the relationship of subject and occupation in the *preparatory* relationship of education which gives rise to entry into an occupation. It is the relationship of subject and occupation in the *synergetic* relationship of education which gives rise to satisfaction, success, and possibly progress in career.

## PERSONALITY ORGANIZATION IN THE EDUCATION AND WORK CHRONOLOGIES AND VITAE

Suppose that we can do for education what we have suggested can be done for occupation, namely to expand by way of some dictionary or school catalogue an individual's naming of the schools and subjects in his educational history. We could then program into our machine the provision of the requirements and prerogatives, the interpersonal, material, and ideational relationships required and permitted, and the experiencing style required and permitted for each school and subject. If we then again consider organization in personality to be the change in one structure to another which a person attempts and effects as he responds vocationally to aspiration in growth, we can again imagine a machine program written so that various characteristics of his educational organization may be inferred from comparison of these structures in sequenced pairs. The details of this machine program remain as necessary tasks to be undertaken, not as completed studies. We don't know much about how epistemological understanding grows.

The existence of educational as well as occupational organization introduces another problem in career which our machine program must handle. I have previously noted the essentially preparatory and synergetic relationships which education may have with occupation in the career. I note here that this relationship may in addition vacillate from time to time in the career. Therefore, our programs which write the interrelationship of education and occupation from chronologies and vitae in those dual realms must pay particular attention to the relationship which one organization is from time to time given opportunity to have on its counterpart organization.

Gribbons' conception of vocational readiness planning (Gribbons and Lohnes, 1968) will provide one of the frameworks for programming the intersection of educational and occupational realms in the career. Crites' (1965) and Super's conceptions of vocational maturity (Super and Overstreet, 1960), will also provide a still higher order conception for programming of that intersection. Finally, Super's metadimensions of self concept (cf. Super, Starishevsky, Matlin, and Jordaan, 1963) as expanded by O'Mahoney's (1968) theory of vocational self concept will provide the programming guides for the intersection of vocation and career.

PERSONALITY ORGANIZATION IN EXPANDED CHRONOLOGIES AND VITAE

The imitation career has so far been described first in terms of a chronology, next in terms of a vita, and finally in terms of a personality organization for each of two realms of activity, educational and vocational. As these descriptions were undertaken, we also noted that the issues in machine programming involved the existence of a dictionary from which structure can be inferred in each realm. Organization can then in turn be inferred by conceiving the problem of expanded linguistic meaning which arises from sequentially juxtaposing the structures of pairs in a single realm presuming that structure is changing in service of the function of growth. Finally, I noted that the existence of two organizations added to the problem of inference that of causing the organization in one realm to be programmed in interaction with the organization in the other. In the interaction I proposed that a critical factor should be the programming of the dominating or coordinating effect of one structure on another as organization changed in the function of growth. In this regard, Super's theory of vocational development (1957) might serve as a first order approximation of the needed programming. However, in all likelihood we will need many more studies on the order of that of O'Hara (1958) which dealt developmentally with the dominating and coordinating effects of awareness in several realms of vocational self concept over each of several years.

The programming so far described can therefore first be considered as a general description. Chronologies, vitae, and organizations in additional realms can then also be programmed to the extent that dictionaries of structure and developmental theories of organization are available. The addition of each new realm must of course be programmed so that its effects will be written independently of other effects in pair-wise interactions with all other effects, in triad-wise interactions with all other effects, and so on up to the final single interaction equal to the total number of realms included in the momentary definition of career in personality.

Matthews (1960) demonstrates that personal and family living is an effect of great importance to career in personality. The programs in the imitation career must therefore also include the structures of marriage and family. It is not yet very possible to write machine programs for the development in personality which includes marriage and family structures. However, Friend and Matthews have case material from which fair approximations will be possible, at least for women's careers. Furthermore, Super's Career Pattern Study (Super, Crites, Hummel, Moser, Overstreet, and Warnath, 1957) can be counted on for information of this nature.

## DYNAMIC PERSONALITY ORGANIZATION IN EXPANDED CHRONOLOGIES AND VITAE

Structures have so far been defined just in terms of *our* knowledge. Let us call this knowledge public knowledge (Landy, 1968).

The machine envisaged [illegible] be one in which the individual may enter *his* programs so that they may also control inferences from chronologies, vitae, and organizations just as *our* programs control those inferences. In fact, we will also speak of a machine which permits the individual to substitute his program for parts of ours as he grows in his understanding both of how to do so and of why doing so is advantageous to him.

In terms of the machine just described, we then trust that it is not too great a jump in imagination to consider a career machine which contains the dictionaries and inferential programs of the individual just as they contain our dictionaries and inferential programs. Let us refer to such knowledge as private (Landy, 1968), or experiential knowledge. Such a machine can then be programmed to give to educational, job, and personal and family living events the *individual's* content as well as ours. For instance, an individual's naming of his job and the company in which it is practiced can very well be expanded by his description of its duties and prerogatives, the interpersonal, material, and ideational relationships it requires and permits, and the experiencing style it requires and permits in relation to the experiencing style effected in non-work environment. These descriptions can be daily ones or of longer periods of time. Normally they are the latter. The descriptions can also include what is hoped and planned for as well as what is taking place. Finally, the description can provide for continuous revision of past impression based on new experience and thought.

By the same token, an individual's naming of a school and a subject in his educational history can be expanded by his descriptions of its requirements and prerogatives, the interpersonal, material, and ideational relationships each has required and permitted and the experiencing style it requires and permits. Again descriptions can be recorded in minute or large periods of time. Normally they are recorded for larger not smaller periods of time. These desciptions can also include what is hoped and planned for as well as what is taking place. Furthermore, each new recording can include revision of former recordings as new experience and impressions expand the meaning of prior events for the individual.

Finally, as has been noted when we spoke about the public organization of personality which could be conceived in one realm, then in two, and finally in any number of realms, similar conceptions of the programs for our machine are possible in the realm of private knowledge. One realm of considerable import is that of personal and family living. Events in marriage and family formation and growth can for each such event be expanded by the individual's descriptions of its requirements and prerogatives, the interpersonal, material, and ideational relationships each has required and permitted and the experiencing style it requires and permits. Again, descriptions can be recorded in minute or large periods of time but for the moment we will imagine programs in which the period is larger, not smaller. Finally, these private descriptions can include what is hoped and planned for as well as what is taking place because our machine permits the direct entry of such personal information without needed recourse to dictionaries and inferences even though such could be personal in the case of private information. Furthermore, each new recording can include a revision of former recordings as new experience and impressions expand the meaning of prior events for the individual.

Suppose, as we did with public knowledge, we define structure in terms of the three elements: 1) requirements and prerogatives; 2) interpersonal, material, and ideational relationships required and permitted; and 3) the experiencing style required and permitted. Furthermore, suppose that in the case of private knowledge, we consider the procedures of 1) review, and 2) planning. Then the machine programs of career in the realm of private knowledge must deal with *both* structure and procedures as they produce personality organization for the function of aspiration in growth. However, the necessary machine programs cannot be expressed in the linguistic structures of our public analysis of personality organization. When we let the individual program his own descriptions of events giving rise to private structures, we allowed the association of our public linguistic framework of organization with the private procedures of review and planning. We can, of course, simulate some of this planning as Boocock (1967) has done in the case of the Life Career Game.

The machine will be programmed to use the data of the Bureau of Labor Statistics to incorporate localized and continually updated projections about opportunity in *occupations* and *education*. This program will be available in connection either with the simulation of the game or with the individual's interactive career describing when he is engaged in the procedure of planning. When the individual is engaged in the interactive procedure of planning, he will also have available another machine program which allows him to find out what educational and/or occupational opportunities are available for his *placement* in the near future.

As indicated, the machine program for dynamic personality organization will make explicit the union of the private knowledge of review and planning procedures and knowledge of psychological processes which can themselves only be private. We shall soon say more about these important processes. We want first to enunciate a seeming difficulty we have bought in the imitation of career at the expense of introducing another's terms into our analysis.

When the individual has placed his own organization of educational, occupational, and generational events into the machine, his organization of each may be compared with our organization of them. This comparison is the central dynamic of personality development. We program the machine so that the comparison is made. However, we must also program the machine with care at this point because we do not want unexamined acceptance of our terms. Instead, we want a condition in which the individual comes to realize a harmony in the structures of form and of his experience.[3] The structures of form are both the public and private structures in his personality organization. The structures of experience are both those unsimulated by the imitation career which is being constructed for him with the machine and those simulated by the machine including simulation of planning and practice in valuing[4] and in relating self concept and occupation.[5]

The judging of harmony in the structures of form and experience occurs in the processes of exploration and commitment[6] in career development. Hence, public developmental programs, vocational or career, must also be first programmed so as publicly to monitor these processes *in the interaction of machine and individual.* Remember that this interaction has now been programmed in our imitation career because the individual descriptions of events in chronologies, vitae, and organizations are programmed for comparison with our public descriptions of them. In the review procedure, the comparison program should foster bisociation (Koestler, 1967) between and among pairs of structures, public and private, in the several realms written into the machine program of the imitation career. The bisociation experience is a part of the exploratory process which the machine program will foster. In the planning procedure, new alternatives and their associated structures are to arise from machine programs arranged so that alternatives and structures can be under private consideration both in a condition of exploration and in a condition of tentative commitment. The difference is that in the exploration process fixation of alternative is likely to be only fleeting, while in the tentative commitment process, fixation on alternative is likely to be more enduring and also likely to lead to expansion in private structuring of one or more alternatives because of the condition of bisociation. The process of commitment is associated with the stabilization of fixation on alternatives for a sufficiently long period of time to permit implementation to occur in relation to plan for personality re-organization in career.

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[3] This concept is due to John Wideman in Tiedeman's awareness. However, Myra Gannaway and Esther Wiedman have given the concept centrality in his concept of the imitation career.

[4] Martin Katz taught Tiedeman the importance of the conception of valuing. He is in turn developing a machine (1968) to relate the concept to educational and vocational development. Hutchinson (1967) has a procedure which makes exploration of the consequences of values possible in the predictive realm of abilities and educational or occupational rewards.

[5] Terence J. O'Mahoney is developing this procedure based on the principle of comparing and indicating preferences for vaguely defined occupational pictures judged in pairs (see O'Mahoney, 1968).

[6] O'Hara and Tiedeman first dealt with exploration and commitment at an implicit level in 1963. In *Career Development: Choice and Adjustment* (Tiedeman and O'Hara, 1963), they implicitly used these conceptions in an analysis of the procedures associated with decision-making in career development. Field (1964) and Kehas (1964) subsequently helped put them implicitly into the context first of purpose and then of self concept. However, it was Dudley (1966) who brought them explicitly to Tiedeman's attention in relation to the choice process. It was Segal who helped him bring them into explicit use in the definition of predicaments, problems, and psychology (1967).

Obviously, the programs monitoring the processes delineated cannot now be written with any precision. Their writing remains a task of the future. However, this should not prevent us now conceiving their existence and in turn conceiving their revision and use on a personal basis on the part of the individual himself. The existence of our monitor creates the structure within which the development of agency in the personality has possibility of forming. Agency exists in the development of initiative while effecting harmony in the structures of form and experience. In the development of agency there therefore exists chance for the incorporation of the structure of our monitored harmonization into the personality itself. The substitution of a personal monitor for our monitor constitutes a recurrence phenomenon which is the ultimate form of the imitation career, namely the developed capacity for harmonization of the public and private forms of harmonies of form and experience. This *instrumental* sense in the imitation career brings into awareness the harmony of form and experience within the linguistics of career.

The harmonization of public and private forms and experiences represents a phenomenon suggested by Landy (1968). Landy proposes that knowledge is public and private, tacit and explicit. Tacit and explicit understanding have been further explicated by Polanyi (1956). Public and private knowledge has been defined in the imitation career. If these two dimensions are conceived as spanning a two-dimensional Cartesian space as Landy conceives them, then awareness of the phenomenon of agency constitutes the personal movement of knowledge from the private and tacit quadrant across into the public and explicit quadrant. Tarule (1968) indicates how this philosophy can be realized in the context of interest, aptitude, and achievement testing. Her structure must therefore be a part of the machine programs creating the imitation career in the linguistic contexts of education, occupation, and generation.

Finally, machine programs in our imitation career which produce the effect of awareness in the individual cause choosing to have explicit form. In the context of choosing, educational, vocational, and generational choices themselves can have explicit existence in the mind of the individual. The patterning of the actual linguistic structure of harmony in form and experience of the individual is his identity. Erikson's schema (1959) of ego identity therefore becomes the final framework within which agency development must be programmed in the imitation career. This is another of the requirements for the imitation career in need of a great deal more work before the imitating of career will become much of a reality.

## CAN A MACHINE DEVELOP A CAREER?

### THESIS

We indicated in the prior sub-section that machines execute procedures and each machine is the embodiment of the procedure it executes. Now that we have defined an imitation career and thereby indicated the public procedures which we want a machine to embody, let us re-address the major question of this sub-section, namely, "Can a machine develop a career?" within that general meaning of machine. Let us do so in terms of three subsidiary questions, namely:

1. Can a machine develop a career *for* an individual?

2. Can a machine develop a career *with* an individual?
3. Can a machine develop a career *for itself*?

## SEVERAL MEANINGS OF "IMITATION" IN LITERATURE IN THE HUMAN USES OF MACHINES

As indicated in the prior sub-section, the conception of "imitation" has several meanings in relation to our general question. One of these senses is that of simulation. In simulation, the machine is programmed to engage as much as possible in human-like functions. Therefore, in using a machine for simulation purposes, one essentially tries to duplicate human processes. Although the question, "Can a machine develop a career *for* an individual?" may at first appear based in the argument of imitation as simulation, this need not actually be the case. Instead, our reasoning will be based on a third, and so far little used sense of "imitation", namely that of an *instrumentality* the examination of which enlightens human reasoning.

A second common sense of "imitation" in the literature on machines is that of artificial intelligence. In this sense, the machine is programmed to do things which *seem* to be intelligent. The ultimate in exhibition of intelligence is of course, the development of programs which give the appearance of learning from past events. This is the goal which creators of artificial intelligence strive to reach. Although the question "Can a machine develop a career *with* an individual?" may at first appear based in belief in artificial intelligence, this again need not be the actual case. As indicated above, the question will be examined from a third, or instrumentality, sense of "imitation." In this third sense as it has been earlier described in the prior sub-section, the imitated is itself an instrument for an artist, or a person in general. In this usage, the instrument is actually known as an imitation and the person is not therefore deluded into confusing his own processes with those of the machine. An instrument of this sort can be a powerful aid to understanding. A person may reason *with* it. A person can learn from reasoning with it and without danger of confusing what he can do with what the instrument can do. Richards (1955) has pointed out the value of such instruments for the study of the humanities. Career is a human product; it must be treated in human ways. Hence, as we examine the general question, "Can a machine develop a career?" we shall always be doing so while conceiving the previously specified imitation career as an instrument *with* which a person may reason, not as a substitute for either his actual career or his intelligence in that actual career.

## CAN A MACHINE DEVELOP A CAREER *FOR* AN INDIVIDUAL?

The imitation career has been specified in terms of machine programs which will printout:

1) a time chronology of a work history;
2) a work vita;
3) the personality organization in the work chronology and vita;
4) the union of education and the work chronology and vita;
5) the personality organization in the education and work chronologies and vitae; and
6) the personality organization in expanded chronologies and vitae.

Specifications of the imitation career in its instrumentality sense are not complete because our existing knowledge of vocational development makes it difficult to provide programs for the enlargement of a vocation into a career, However, we did note that the *Dictionary of Occupational Titles* and supporting work by the Bureaus of Employment Security and Labor Statistics makes it possible even now to infer occupation from job titles. The work of Holland and Roe also makes it possible to infer vocation and at least advancement as an aspect of career. Furthermore, their work and that of Bordin, Nachman, and Segal (1963) and Cooley additionally unite some of the childhood and educational history with the vocational history. Finally, Super's work on vocational development makes it somewhat possible to program development in personality organization.

This accumulation of what we know about programming in imitating a career in the simulation sense is not impressive. A lot of additional research is needed before we can approximate actual careers through programming an imitation career. However, there is nothing inherently impossible, from the standpoint of a machine, in developing careers *for* individuals, at least in the sense of being able to imitate a career in the instrumentality sense of "imitation". It is quite true that in our present state of knowledge, the imitation will fall far short of the actual career. However, the non-correspondence of reality and imitation is our fault, not the machine's fault.

## CAN A MACHINE DEVELOP A CAREER *WITH* AN INDIVIDUAL?

The final part on the imitation career specified the programs which would be required to imitate the *dynamic* personality organization in expanded chronologies and vitae. That part was developed on the assumption that a career is not just something which is written; it is something which is had. In having a career an individual comes into interaction with the part of the machine instrumentality that can write a career *for* the individual. The imitation career in its simulation sense in turn programmed this interaction so that balance in the structures of form and of experience was continually weighed by a monitoring function. However, the imitation career in its instrumentality sense let the person substitute his monitoring function for ours as the person proved capable of writing his *own* machine which would possess the balancing effect in structures of form and of experience.

As we did what we could to specify the machine programs which will simulate the things claimed for them, we took recourse in Gribbons' work on vocational readiness planning, both Crites' and Super's conceptions of vocational maturity, Katz' conception of the valuing process, and Erikson's conception of identity. That work and those conceptions offer the best approximations now available to the form a machine should be given to develop a career *with* an individual. However, we should again note that the present large gap in the correspondence of actual and imitated careers which persons are having is no obvious reason to dissuade us that a machine can develop a career *with* an individual. The problem is not to abandon attempts to create a simulation machine which will develop careers *with* individuals. The problem is to make our simulation machines which do so prove able to do a more effective job of it. Such improved simulation machines will still not destroy their instrumentality effect.

## CAN A MACHINE DEVELOP A CAREER *FOR ITSELF*?

We have already argued that a machine can develop a career *by* itself. The career, of course, is not that of the machine; the career is that of the individual which the machine imitates in an instrumentality sense.

We have also already argued that a machine can develop a career *with* an individual. However, in doing so, we noted that the person had to be in actual interaction with the machine. Furthermore, we were careful to say that what was originally our monitoring by simulation of the individual's balance of structures in form and experience was gradually to be replaced by the individual's valuing of that balance. It would appear then that a machine can *not* actually develop a dynamic personality organization in expanded chronologies and vitae by itself. But wait, as research in the interactive functions of an individual engaged in personally determining his career progresses, we will in turn be enabled to program the machine so that it can write monitoring programs more closely approximating those written by individuals in the past. Patterning in that activity probably exists. When known, it can be turned into a machine program which will develop a career by itself, even in the second or dynamic sense of career. This will be an imitation career in the artificial intelligence sense of "imitation" as well because it will then become a self-correcting program.

Before despairing for humans, however, carefully note that this argument based in the recursion argument collapses in its limit. There will *always* be some stage of the recursion in which more experience must be accumulated in the present in order to make the machine be more effective in the future when the programming is done on the basis of prediction. Thus although the above forms of argument get us far down the road toward believing that a machine can write a career for itself in the sense of artificial intelligence, we still have not fully addressed the question, "Can a machine develop a career *for itself*?"

In its most general form, the question, "Can a machine develop a career *for itself*?" essentially asks, "Can programs be written for the machine which will have the effect of *giving* the machine a career?" If we can determine to what extent we can generalize the programs in which the machine develops dynamic careers *by* itself in the artificial intelligence sense of imitation, we can determine to a greater and greater extent what a machine does when it develops a career *for* itself. Doing so would considerably advance the language and ultimately the theory of career development. However, it would not of course either substitute machine careers for human careers nor deny the sense in which the imitation career is an instrument, not a master. Since we have argued by recursion, not by direct logic, we know that the esoteric career will still exist. The imitation career can only in turn make it better understood, publicly and privately.

### THE VALUE OF THE QUESTION

We trust that the value of the question, "Can a machine develop a career?" now has some balance of its form with your experience. If so, you will probably attribute value to the question. If not, we have not yet proved convincing. To those not yet convinced, we can merely list here the value which the question has had for us.

In examining the question, "Can a machine develop a career?', we first had to specify the imitation career as an instrumentality in career development. In specifying the instrumentality of career development, we therefore moved the language of career development into explicit form so that it may now be investigated by anyone. We have also indicated how we fit the vocational development work of Bordin, Nachman, and Segal and of Holland, of Roe, and of Super into that instrumental framework. We additionally indicated that, with our procedure and more research, we can later provide machines which will probably do a pretty fair job of developing careers *for* individuals in the simulation sense of "imitation." Furthermore, we have indicated that with use of that research we can in turn start doing a reasonably good job of providing a machine which will develop careers *with* individuals in the instrumentality sense of "imitation." While doing that we also succeeded in explicitly defining processes of exploration and commitment in career development. Finally, we have indicated that several years or so of doing the latter can in turn give us a machine which will do a fairly effective job of developing careers for itself in the artificial intelligence sense of "imitation." However, in conclusion, we admit that we should turn the whole argument into a new set of questions in order to address more squarely the problem of generating a machine which will both develop careers for itself and counsel. Such an address really gains the admission which relaxes us all, even those really helped in their career development by machine. Machines don't actually develop an individual's career. Machines can only *help* individuals *understand* their career development. To this end machines are instruments, not masters, in career development.

## CAN A MACHINE ADMIT AN APPLICANT TO CONTINUING EDUCATION? SELF-CORRECTION AND COLLABORATIVE PROCEDURALIZATION[1]

### PROCEDURALIZATION AND SOCIETY

ISVD assumes that something can be computerized without fully proceduralizing it. In the second sub-section, we indicated how the ISVD uses this notion to provide a counseling environment, namely an environment in which the person has responsibility for proceduralizing that part of his decision-making development not computerized by ISVD. In the third sub-section, we indicated how the ISVD will proceduralize career as an imitation career. We concluded our consideration of this problem by noting how the machine capacity to develop careers for and with individuals and by itself can probably be improved. However, we still carefully noted that construction of machine capacity for the improvement of career development basically requires individuals who can sense the ISVD career machine as an instrument improving their *own* comprehension of their careers because of the counseling environment in which the ISVD career imitating is embedded.

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[1] This sub-section is based on Project Report No. 19, "Can a Machine Admit an Applicant to Continuing Education?" by David V. Tiedeman.

The development of responsibility for one's own career can never be completed in the interaction of man and machine alone. Man to man interaction is vital as well. The person to person interaction needed is both actual and virtual. The ISVD will eventually outline the actual interaction required to make the assumption of responsibility for self in career a reality for citizens in the United States. However, this actual task also requires that the virtual interaction be built into the inquirer-machine interaction as well, thereby giving preliminary form to the later personal interactions actually required.

This sub-section outlines the virtual interaction among persons which will be required to facilitate emergence of belief in one's self-correcting capabilities as he grows up. However, we again do so by examining the question, "Can a machine X?" in order to continue a form which has consistency from first principles in the counseling environment. X in this sub-section is taken to be the action of admission as it is offered to another presumed to have applied for entry into continuing education. The form addressed thereby is that of our society, namely group renewal by new members conceived as petitioning for membership. The basic question then becomes that of satisfying the requirements of another and of considering the authority and its basis inherent between the person petitioning and the person evaluating another. The specific question addressed is: "Can a machine admit an applicant to continuing education?"

In order to free the machine from the encumbrance of unnecessary procedures arising from fashioning its programs so that they either are or act like humans, let us do as we did in the sub-section in counseling, namely, merely examine procedures in which *the ends of the admissions officer and the ends of the machine are identical.* It shall therefore *not* be necessary that the *means* of the admissions officer and of the machine be identical although there is also no reason to avoid making their means alike when doing so does not needlessly encumber the machine.

## PURPOSE OF ADMISSIONS TO THE CONTINUATION OF EDUCATION

### A SATISFYING EDUCATION WHEN CONTINUED

Let us take the purpose of admission to continuation of education to be the acceptance of candidates likely to prove satisfy*ing* to the goals of the institution and the rejection of all others. In short, the applicant must *himself* become satisfied *with* his education *while* he is being educated. The implications of such inclusiveness are 1) that admissions officers cannot be satisfied merely that their admitted candidates are satisfact*ory* upon admission, and 2) that the symmetry necessarily implied in *educational* satisfaction requires both that the applicant as later student become satisfied during his admission and education and that the institution as resource for enlargement of the student's intelligence be satisfied throughout the applicant's admission and later education.

If the continuation of education is to prove satisfy*ing* to the goals of the institution admitting the applicant as specified, admitted candidates who by then are students must *themselves* set goals for the institution. Students who do so give the institution chance of viable existence. Students who live by personal goals at admissions will let the institution exist so that they can in turn assume obligation during their education to live with its goals as well. Students who live the goals of the institution will both live *by* them and live *with* them. In living *with* the goals of an institution, students will become the critics of those goals and offer the institution opportunity for its perpetual change—probably its improvement as well.

### SELF-CORRECTION AND THE SATISFYING CONTINUATION OF EDUCATION

Institutions and admitted applicants will prove most satisfy*ing* to institutional goals if both are subject to expectations for self-correction (Gannaway, 1968). The basic process of self-correction is creation. Ideational creativity, the goal of education, requires the student to relate himself to his experience and his environment so that he is both tentative about some things and from time to time committed to other things. These dual conditions permit the mind to play with ideas both as wholes and as parts. The wholeness of an idea allows one to deal in theory with its conceptually divided parts. The parts of an idea allow one to experience ideational aspects of a totality in intensity necessary for comprehension of the totality. Frequently the whole suggests parts not yet envisioned. Occasionally parts coalesce into wholes as yet unimagined. Maintenance of the belief in one's capacity for self-correction affords safeguard for the fact of self-correction. Since any belief is itself personal and inseparable, this belief like all beliefs must be *experienced* as a whole although *we* can encourage its emergence by our partial action.

The maintenance of the sense of self-correction makes demands on applicant and institution alike. For the institution, the belief means 1) that a significant portion of its officers are capable of self-correction and 2) that the organization of the institution does not contradict the expectation for self-correcting activity on the part of such enlightened officers. For the applicant this means 1) that he must be given opportunity to share in goal determination of the institution even at the time of his admission, 2) that he must perceive this opportunity as fairly offered and fairly administered, and 3) that he must be capable of self-correction at his admission and throughout his education in the institution.

## SCIENCE AND SELF-CORRECTION

Self-correction is the attitude foundational to science, as well as to personal development. We therefore further elaborate meaning of self-correction in personal development through consideration of the more commonly understood principles of science. We refer, of course, to the *process* of science, not necessarily to the *products of scientists.* Informal and formal testing both are inherent in the process of science. We shall consider the role of both kinds of testing in the conduct of science.

We engage in informal testing intermittently in daily living whether we are scientists or not. Through such informal testing we sharpen in self-correcting ways our understanding of the relationship between ourselves and our experience and environment. Scientists additionally formalize such thought, or tests in which they are willing to think one way or another depending on the outcome of an observation contingent upon a prior supposition, and call it "doing science." Scientists "do science" with concepts they have formed about their relationship between themselves, their concept, and the experience which they are attempting to understand by means of their concept. This idea about science is not novel. Polanyi relies upon it (1966). Bronowski (1965) additionally explicitly grounds the identity of man in it.

The primary paradigm of self-correction as "doing science" is that every man seeks clarification of the relationship between an idea he has and his experience (including others' summaries of that experience). If power is expected from this primary relationship it must be additionally studied in a secondary relationship in which one comprehends his person both as the inventor and evaluator of the concept and the agent of experience of the phenomenon under study. Actually it is impossible to separate in experience the primary and secondary relationships; the one continually interacts with the other. It is therefore necessary to conceive the two as figure and ground in phenomenological interaction. What ordinarily eventually happens when comprehension takes place is that concept and experience are given primary position as figure within the ground which is the "I-and-concept" relationship. The processes by which this effect happens occur normally. However, it is also possible for these processes to become much more available in awareness. Furthermore, it is possible for that awareness further to sharpen decision-making activity, particularly personal responsibility for decisions. The comprehension of the process itself matures very slowly in man's cognitive development. As we have indicated in our prior discussion of a Career Machine, the effect can be helped to occur sporadically throughout life. However, comprehension of the general elements of the process occurs more slowly and largely in terms which so far have only been described in metaphysical terms. However, illustrations abound in which the capacity to comprehend process has reality, even if only an illustrative reality in each of many specific instances. It does therefore appear to be a developed capacity of which man is actually capable even though the processes inherent in the secondary differentiation seem to mature more belatedly than do the processes inherent in the primary differentiation.

Formal testing differs importantly from informal testing. The important difference is that formal testing must be conceived in public terms; informal testing can occur largely in private terms.

## "DOING SCIENCE" AND FORMAL TESTING

The scientist tries to bring into the public realm the understanding which he achieves because of informal tests of his concepts and experience. This advance requires that understandings which are formerly tacit must be made explicit. As the scientist makes his tacit understandings explicit, he moves them from his private realm to the public realm. As the scientist moves his understanding from his private realm to the public realm, he finds himself explaining not alone what he knows but also the bases upon which he claims to know it. These bases as they enter the public realm become the material which others can use to examine the scientist's impression of what he understands. In the pursuit of science, those bases occasionally become formalized and serve as tests which other persons in turn apply to the relationship between concept and experience which the scientist claims he understands. As this process occurs, investigations which are formerly fluid (Schwab, 1962) or "whole" later become static (Schwab, 1962) or "partial." In static or partial investigations, the bases of understanding are kept fixed while the realms of application of those bases are varied. Static investigations therefore ordinarily expand and clarify just the limits of application of an original understanding. Fluid or whole ideation on the other hand, is ordinarily relatively free of former restraints placed on static investigations. Such freeing in turn allows concepts and experiences to be "seen" and presented in new lights. When the freeing is a superordination of previously less well ordinated static restraints, science or persons are said to progress. When the freeing is the establishment of new restraints but in a different field of awareness, science or persons are said to become diversified or the like.

### MEANS AND ENDS

We have so far first argued that the purpose of admission in the continuation of education should be the acceptance of candidates likely to prove satisfy*ing* to the goals of the institution and the rejection of all others. We then argued that the sense of self-correction must be preserved if students are to achieve a continuation of education satisfy*ing* to applicant and institution alike. We finally noted that awareness of "doing science" in personal living, particularly the doing of "formal testing in science," is the aspect of self-correction critical to a satisfy*ing* education.

We undertook our specification of purpose in admission to the continuation of education so that we may now note a fundamental flaw between the way tests are presently used in admission to continuing education and the end of cultivating self-correcting activity because of admission and study in continuing education. The flaw is that applicants are not *collaboratively* involved by admissions officers in the problem of goal specification and pursuit in the admissions process. Tests by themselves offer no present opportunity to correct that situation. The Admissions Machine we specify must eliminate this flaw if it is to operate in the ISVD counseling environment.

## AN ADMISSIONS MACHINE

### AN ADMISSIONS MACHINE AS AN INTEGRAL PART OF A CAREER MACHINE

If self-correction is not to be seriously contradicted during admission to the continuation of education, admission should be carried out as an integral part of the emerging self determined and corrected career. The cultivation of the awareness of "doing science," particularly the awareness of "doing formal testing," in living can be achieved during admission to the continuation of education if the needed Admissions Machine is planned as a part of the Career Machine specified in the previous sub-section.

The ISVD system will use the Tiedeman and O'Hara paradigm of decision-making in vocational development as an explicit model which inquirers will be expected to master through repeated use of the ISVD. However, more importantly, through interaction with the system and with counselors who are aware of and attempting to facilitate the more general effect, inquirers are expected to master the epigenetic *process* of decision-making development or of "doing science" itself. Inquirers having such mastery are skilled in the use of purposeful action (Field, 1968), of self-correction (Gannaway, 1968), and of "doing science" or reasoning either in the sciences themselves or in the humanities as well. (Richards, 1955.)

## THE ADMISSIONS MACHINE IN BROAD OUTLINE

The existence of an ISVD Career Machine simplifies the admissions process if applicant and admissions officer both believe that the other is self-correcting and mutually decide to *share* facts and data in order to collaborate in deciding, as the admissions officer must, whether this particular applicant should be admitted to his particular institution or not. The prior uses which the inquirer had made of an ISVD would give him a means of now characterizing his decision to apply to a particular institution so that the admissions officer could, with the inquirer's permission, be privy to *what* and *how* he had thought, not just *that* he capriciously now wanted admission to institution X. The admissions officer could examine this record for detail, complexity, integrity, and self-correcting activity. The admissions officer could also plumb the record for the goals which the applicant wanted to fulfill and for the applicant's justification that such goals could be fulfilled collaboratively at institution X with its now stated goals and existing procedures for self-correction of institutional goals.

The self-correcting processes which Bronowski (1965) and Gannaway (1968) define depend upon the individual's capacity to examine honestly and continually the relationship of himself to his experience. When an individual is doing so he is in reality acting as a scientist about his self-processes. The major issues in such an examination at the time of application to continuing education are 1) the nature of the outside as that outside is known to others, and 2) the nature of purpose (Field, 1968) as its nature can be known collaboratively to applicant and admissions officer alike. The Admissions Machine should therefore contain an Admissions Game which can be used by an applicant in familiarizing himself with another's experience about admissions to continuing education. The further widening and deepening of the context for collaborative testing action between applicant and admissions officer which will be outlined later can then help both to move the decision of admissions from its present base which is almost gamelike to a more intimate base in which the aspirations and evaluations of applicant and admissions officer are more penetratingly known to both. The instrument for such exchange will be a computer-based *interactive* admissions system, or an Admissions Machine. In such systems, an admissions officer can combine both the Admissions Game and his subsidiary decisions. The embedding of game and decision bases into an interactive information exchange will naturally expand the area of application of the admissions officer's thought about applicants and their intentions and accomplishments. The use of such an extensive system will give applicants a sense of participation in admissions to their continuing education.

## IMPLICATIONS OF AN ADMISSIONS MACHINE FOR TEST THEORY AND PRACTICE

### TESTING FOR ADMISSIONS TO CONTINUING EDUCATION

Although the admissions officer would gain from the availability of an ISVD-like self-correcting record of an applicant's career as noted, there will undoubtedly be additional information which the admissions officer would like to have. The desired additional information would likely be both of a factual and of a test kind. The needed factual information is likely to be specific to an institution and should be planned and obtained from institutions with that expectation in mind. However, the problem of testing in a potential Admissions Machine merits further examination because it is the principal effect which ISVD seeks to help inquirers internalize.

### THE PROCESS OF SCIENCE AND ADMISSIONS TESTING

The process of science contributes in two ways to admissions testing. First it forms a means of showing what admissions testing presently is. Secondly it suggests a model of what admissions testing might become.

Admissions testing presently takes place under static conditions. For all practical purposes, psychometricians presently conceive admissions testing merely on grounds that an institution can know what it wants and how to get it by comparing predictor indexes with the series of grades achieved by the institution's classes of the years past. Psychometricians thereby cast the admissions problem into a static mold because it is conceived as merely requiring identification of characteristics visible prior to admissions which bear the transition from preadmission circumstances to the satisfac*tory* post-admissions continuation of education.

The present procedure of formal admissions testing thus constitutes only a feed*back* loop, that is the criterion is fixed and the test and associated admissions studies provide probability data in relation to the fixed criterion. A feedback system is static so far as its restraints are concerned. However, one of the ways in which a feedback system has been moved toward a dynamic or more fluid condition in which feed*forward* (Richards, 1955) then starts to be available has been to use the results of feedback obtained within existing constraints to make the feedback operate to correct the direction in which an object is moving. This is the sense in which feedback operates in missile guidance systems, in power steering of automobiles, and the like. This is also the sense in which psychometricians presently construe guidance as based in existing test theory.

If the planning function of an ISVD-like Career Machine were constructed and used as an Admissions Game in an Admissions Machine, we would create a first movement from a static test system to a dynamic information-creating system. Although the static system of college admissions based in present selection tests is for the most part presently deterministic, the effects of some of that determinism can be somewhat alleviated in the students subject to it by also causing them to comprehend the "theory of the Admissions Game," as well as to take tests processed in secret by admissions officers. This is equivalent to the takeover of the public monitor by the inquirer as described in the ISVD Career Machine. Students who become expert in such a game are more likely to petition for admission to continuing education on grounds which allow them to act a little more intuitively within both the restraints of the present "game" and the operation of those restraints on their desires. This is the first stage of moving admission to the continuation of education to grounds which are more fluid or self-correcting than the existing static grounds.

## WIDENING THE DATA CONTEXT IN FORMAL TESTING

It is now possible to widen the context of data processed by admissions officers without sacrifice of either accuracy or accountability. The widening can be accomplished by shifting the basis of questions from multiple response to free answer. This alternative has not in the past been fully exploited both on grounds of feasibility (it takes too long to process answers in the short turn-around time between receipt of answers and need for processed results) and on grounds of reliability (you can't get readers to agree on evaluations of responses). These objections are of a different kind and should therefore be dealt with on different grounds. The availability of computers now makes it possible in short order to process a response entered into the computer by an applicant. In fact, the computer can convey its response to the applicant himself as well as to any other party permitted access to the question-response sequence. Thus the matter of time becomes irrelevant if we program testing so that questioning, answering, and processing are done almost simultaneously.

The other objection has to do with the reliability of evaluating free response questions. Philip Stone and associates (1966) have developed a procedure for computer recognition and response to key words in context. Fred Ferris (informal report, 1968) has picked up this processing idea and exploited it in relation to the provision of College Board test items which can be answered as problems, not as selections among previously provided possibilities. With care, it then becomes possible to write questions as problems and to provide for the processing of answers according to analyses of key words in context.

If the processing of key words in context is done while the applicant is in active interaction with computer programs, further gains become possible. These further gains are 1) that the responses identified by the computer can be relayed to the applicant before he leaves the system, and 2) that he can be asked to verify or revise such identifications before he leaves the system. The applicant's revisions can in turn be made a matter of record and report to the admissions officer. This procedure therefore bypasses one of the major problems of reliability, namely keeping the process sensitive to what the applicant intended. An additional gain is that the computer program can also report to the applicant what he has replied in relation to its processing by the test-maker's judgment of the 1) complexity, 2) completeness, and/or 3) accuracy of his answer. What we are remarking upon here is a new form of reporting, not a reporting which merely relates to the ultimate correctness or incorrectness of a response. We are suggesting a response processed according to the numerous alternatives which surround the tackling of a problem. This possibility has some exciting additional consequences. It bypasses the problem of reliability still further than that already achieved by getting the applicant in on the scoring of his response. This time the bypass is to have the test-maker provide scoring of the response in outside terms and then to use that outside scheme both to score the response in his terms and to share the report of such scoring with the applicant. In sharing the scoring report with the applicant, if the applicant notices anything awry with his score, he can report such impressions. This eliminates another issue in reliability. However, the major reliability issue in test theory has to do 1) with the sampling of questions which are included in a test, and 2) with the assessment of the possibility that the level of a person's score on a sample of test items will remain relatively constant in relation to a comparison group when both sampling of content and testing of applicant is varied. Why sample content? Why compare applicants with other applicants?

We ask difficult questions. However, in its ultimate form, sampling content is indefensible. It may prove valid with a few things like sets of arithmetical operations. However, in a real sense each question is a unique question. When different questions are placed in sets, their categorization then becomes subject to question by anyone who knows the subject. These questions are ordinarily argued in test construction committees. Placements of questions in categories are ordinarily consensually achieved, not individually held. However, the placement of questions into tests is a serious problem which probably shouldn't at all be delegated by admissions officers to test committees. Are there ways in which admissions officers can deal with such decisions themselves? There prove to be ways when the selection of questions for answer are left to the applicant and when the entire set of questions from which the applicant can draw is known to the admissions officer. If an applicant is allowed to respond to questions on line with computer programs and if the processing of responses is arranged as noted above, then the record of response transmitted to the admissions officer can be not alone the applicant's processed answer to a problem (complexity, completeness, accuracy) but also general statements (in the particular admissions officer's own terms should he desire such a report) of what categories of questions were attempted and what categories of questions were not attempted.

But how then does an admissions officer compare one applicant with another? This is, of course, the major question when an admissions officer attempts to place the requirements for limitation of applicants into the substance of a set of applicants' responses to the universe of each of several subjects of man's knowledge. One thing we have been attempting is prevention of a quick answer to this question. We have been trying to lead you to understand that the psychometrician's prior habits of doing a lot of the deciding *for* an admissions officer are no longer necessary. It is now possible to put before admissions officers themselves a lot of the data on which test committees currently themselves act. It is additionally possible to get that data to an admissions officer in forms such that it has been previously dealt with by each of the applicants to his institution before the admissions officer is required to act upon it. Hence we would be giving the admissions officer an opportunity to form his impressions about individuals in a substance which is unsummarized prior to his receipt of it but which is available for his summarization in terms including the responses of his applicants. Furthermore, for admissions officers who want such help, it would be possible to work out computer programs partially summarizing *in terms of a test's content itself* whatever the admissions officer may himself want.

## SHARING ENDS DETERMINATION IN SELF-CORRECTING INSTITUTIONS

It is now possible both to widen the context of data processed by admissions officers and more fully to share the problem of ends determination with applicants at the time of their application. The first point is argued above. Let's now look at the second point.

Institutions pursue their objectives on grounds that *their* use of students who are their human resources actually benefits society. These goals and judgments on which they are advanced are currently in serious question by students. We don't mean to favor one set of goals over another. However, we do argue the applicant's right to make an institution aware of *his* intended use of it as well as the reverse which has been the singular asymmetry of views upon which admissions decisions have so far largely been based. *The young individual must come to know that his society is in him as well as he in it.* This knowledge is not readily come by in our present society in which the transfer of the societal navigation from others to each person is so solidly impenetrable in our present educational institutions. At the present time we make every effort to keep a youth in educational navigational systems for a long time and then to release him, naked as it were, to personal navigational systems at the end with little or no effort to cultivate what this shift *itself* entails. This assertion is subject to debate. Nevertheless we make it on grounds both of the present lack of extensiveness of the infrastructure we know as guidance and of the inadequacies of the theory on which guidance is practiced even in that constricted condition of availability.

If we are to improve the theory on which guidance operates, it will have to become involved in the basic substance of guidance, namely the self. We do not use the concept "self" loosely.

We are aware of its history in metaphysics. We too find it mercurial. However, for our discussion, we have used Bronowski's definition (1965). That's a clear definition at any rate. Like Bronowski, in talking about the "self" we therefore talk about the *grounds* which are available to personal awareness. Unlike Bronowski we explicitly argue that comprehension *can* be facilitated *of the processes* by which that availability occurs. This is why we are offering this section for consideration.

The key assumption in our belief is that self-awareness deepens and widens with the comprehension of the processes of choosing. The choice of admissions to continuing education is one context for choice. In the context of admissions to continuing education, the applicant is required to place what he knows in juxtaposition with what he wants. He is then in a position to advance what he wants in terms of what he knows using the resources of an institution of continuing education as a means for his intention and plan. If the admissions officer is to have sufficient inkling of an applicant's intention and plan, he must have a context in which what the applicant knows can be advanced to him in relation to what the applicant wants. This conjoint pair of conditions becomes possible in a computer-based interactive exchange system such as the Career Machine. Also, this conjoint pair of conditions is better grounded if its origination occurs in the substance of free responses to problems as advocated for the Admissions Machine part of the Career Machine. However, free response to problems will not be enough. What the admissions officer should additionally seek is information concerning the applicant's ability *to form* problems, not just to solve them. If applicants can only solve problems, they tend to know and interact with the world largely in another's terms, not in their own terms. If an applicant is able to form problems, he is able to react to the world in his own terms as well as in another's terms. If the admissions officer watches an applicant include the views and purposes of others as he advances his own purposes, he can get a substantial view of the sets for accomplishment and for use which an applicant is likely to bring to the institution with him if admitted.

## CAN A MACHINE ADMIT AN APPLICANT TO CONTINUING EDUCATION? OUR CHALLENGE

In conclusion, let's return to the question, "Can a machine admit an applicant to continuing education?"

We posed the question without expectation that we would answer it affirmatively. Instead we merely proposed that we take it seriously in order to gain new perspective on the theory and practice of testing. The created perspective started from the purpose of admission to the continuation of education as the inclusion of those likely to prove satisfying to the goals of the institution and the exclusion of others. We then expanded that purpose to incorporate the goal of self-correction and the procedures of science as means compatible with achievement of that goal as a generalized attitude.

Having proposed a purpose for admissions to the continuation of education, we outlined an Admissions Machine consistent with its attainment. Finally, we used the Admissions Machine to adumbrate the assumptions of formal testing in order to pinpoint assumptions in the theory of testing which can be changed as the practice of admissions embraces the concept of an Admissions Machine.

What we propose as necessary is difficult. We have essentially suggested that the major purpose of education is to *help persons* clarify *their own* relationship to language and experience. Admissions to continuing education must be consistent with that purpose. To have such consistency, admissions to continuing education should be offered in expectation of self-correcting activity on the part of an applicant and in an atmosphere in which the applicant will agree that such has fairly been the case.

Our proposals challenge cherished assumptions in testing and admissions to continuing education, activities which have become relatively inseparable at the present time. Testing theory is largely defined in terms of admissions purposes; admission practices largely follow test theory. However, our proposals have been accompanied by relatively explicit reasoning. New means by which the pragmatic can approach the ideal have simultaneously been proposed. The concept of a machine is the principal means of both being explicit and proposing how the ideal is within realization. We make no claim that the proposed is easy of attainment. We do not even make a claim that a machine *can* admit an applicant to continuing education. However, we do claim that examination of the question *as if* a machine *could* admit an applicant to continuing education has given us a new way to question fundamental purposes and means in admissions to continuing education. In doing so, we have exposed essential flaws in our old means, test theory itself. The flaws consist of purposes realizable by machine and not by test and of the subsequent improvement of test means by machine means.

Fundamental questioning of our purposes and means is vital in our times. To fail either to question in the terms here advanced or to act on new grounds about which we are consensually convinced will be to abandon our present institutions of higher education to new forms in which the self-correcting activity now being sought by college students will find more friendly havens elsewhere.

## CAN A MACHINE EDUCATE? INTERNALIZATION OF PROCEDURALIZATION THROUGH 1980 VOCATIONAL EDUCATION AND GUIDANCE[1]

### INTERNALIZATION OF PROCEDURALIZATION

This section on the Theory and Design of the ISVD has so far taken the basic assumption of the system that something can be computerized without fully proceduralizing it through three phases. In the first phase, as undertaken in the second sub-section, personal responsibility for further proceduralizing the ISVD was outlined. We there outlined the counseling environment which could be computerized in order to make personal proceduralizing possible. In the third sub-section, the second phase of the problem was outlined, namely, public specification of career so that its internalization would not contradict the ISVD assumption when undertaken in the ISVD counseling environment. Finally, in the immediately preceding sub-section, we extended this argument by dealing with means whereby expectations can be advanced and explicitly acted upon without compromise either to the expectations themselves or to a specific expectation for self-correcting activity on the part of inquirers.

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[1] This sub-section is based on Project Report No. 18, "The Cultivation of Careers through Guidance and Vocational Education," by David V. Tiedeman.

In this sub-section, we undertake further generalization, namely generalization from the specifics of career to the essence of education. We again implicitly address the question, "Can a machine X?" However, this time our question returns to the general level at which we started, namely, "Can a machine educate?" We address this question is relation to vocational education and to secondary education. However, we trust our prior discussion suggests that secondary education is readily generalizable to continuing education when the spirit of self-correction which we are trying to engender and perfect by way of the ISVD concept heartily exists.

## VOCATIONAL EDUCATION AND CAREER

Vocational education presently enjoys a comfortable degree of public support in today's educational enterprise. On the one hand, citizens in the United States believe that vocational education is a means of solving immediate social woes because it provides needy persons with work skills which in turn allow them to live in the dignity of return based on competence, effort, and risk of self regard. On the other hand, citizens believe that vocational education must also help solve the longer term problem of changing the work patterns and forms of economic return of each person so that new forms of productivity can more easily and continuously take their places in our progressing civilization. We shall argue that this latter goal requires education for *career* skills but not at expense of the education for occupation and work skills which we presently attempt in our today's vocational-technical education.

Shortsighted citizens, politicians, and educators occasionally speak and act as if these two national vocational goals cannot be achieved simultaneously. Unfortunately, the cause of vocational education suffers from such talk and action; two necessary activities are then erroneously brought into competition with each other by unscrupulous persons who may want either one of the goals at any cost to the other.

In this sub-section, we particularly address the second goal or long term goal for vocational-technical education, namely that of changing the meaning of work for citizens. In doing so, we do not mean to detract from an immediate goal of vocational-technical education, namely that of aiding our country's attainment of full employment. Full employment must take place just as soon as the reason and passions of men will permit. Nevertheless, the long view must also be enunciated, clarified, and advocated along with that imperative if the necessary is to have the force of understanding, not just that of toleration. This then is our present task, namely to enlarge understanding of the career for the individual in order to put the imperative need of work for everyone more into perspective.

## SECONDARY EDUCATION 1980

Let us address the matter of career through vocational education by thinking of the future. We do so in order to help us see our current activity in terms of what it might become, not just in terms of what it is. Each of us needs to get above his daily activity from time to time in order to see what is possible and needs to be done. When we attempt such a perspective, we may well simultaneously despair of attaining the possible because we think that needed changes will have to go on immediately. Actually change can take place slowly if it is directed by our existing intentions. It is for this reason that we elect to think in terms of secondary education as it might be in 1980, not as it is in 1969. The eleven-year span necessary to accomplish the considerable change now possible to us may well make the difficult more desirable in your mind. If so, we will have accomplished our objective, namely to make you discontent with what you do now because you see goals and means of doing a needed and better job in the future.

The mere desire to think about a high school in 1980 presents a trap we should avoid, namely the trap of construing secondary education in terms of a high school, or for that matter, of any school at all. But if we do not think of our subject as that of a high school, or of at least a school, how can we conceive it?

In this sub-section, let's consider secondary education, not a high school. However, we need some bounds. Therefore, let's first bound our concept by age. Let's take the lower age bound of our imagined secondary education at about age 12, not age 14. However, let's not bother to bound the upper age of the concept. Secondary education shall be conceived as enjoyed at any needed and/or desired time of life once an elementary grounding exists. Thus secondary education can more readily blend into continuing education.

By choosing 12 years as the lower age in which secondary education is to occur, we can examine guidance and psychological services associated with secondary and vocational education in terms of both the adolescent and adult periods in human development. We of course gain capacity to discuss education in terms of human development rather than in terms of school organization at expense of difficulty in specifying the epistemological limits which will then actually restrain secondary education of 1980 with its associated career and vocational education. However, several guidelines can nevertheless be imagined with profit. For instance, let us presume that 1980 secondary education has been preceded by an education which in one of its aspects has already created skill in reading, writing, and reckoning. In others of its aspects, let's also presume that the prerequisite elementary education has provided further specific cultivation 1) of interpersonal skills and 2) of inquiry in scientific, social scientific, and humanistic realms from levels in which they are naturally initiated in childhood by the family.

In our 1980 secondary education, *individually* elected paths in the realms of science, social science, and humanities can then be presumed available to students. There will be no required courses in our secondary education. Furthermore, education is to take place in experience, not *just* in books and classes. Thus distinctions between so-called general and vocational education in today's secondary education will have no real validity in our 1980 High School. For all these reasons, secondary and tertiary education in our future for education will be relatively indistinguishable, education beyond elementary education will be continuing education. However, one distinction which ought to prevail is that students in our 1980 secondary education 1) be adolescent if they are educating themselves in immediate succession from elementary education, or 2) be in presumed need of a more highly *supervised* introduction to continuing education if they are then present in secondary education after having absented themselves from education for an extended period of time. In sum then, what we presume is that our 1980 secondary education should be reserved for those in need of an interdependent, not *completely* independent, learning experience in order further to progress in the expansion of their intelligence and career according to their own purposes. The consequence of this presumption is that either adolescent or adult students who *can* profit from highly independent study and experience will actually be in tertiary, not secondary, education.

Finally, let's imagine secondary education taking place in a Learning Resources Center, not in a high school. The present theory of guidance suggests that such an organization of secondary education is not only possible but also desirable as an improved educational experience for all. The imagined existence of such an organization, challenges the mind to state both how the organization can be realized and what that realization will in turn require of guidance and psychology in 1980.

## LEARNING RESOURCES CENTER 1980

### INTEGRATION WITH SERVICES OF THE COMMUNITY FOR A SENSE OF COMMUNITY IN SERVICES

Learning Resources Center 1980 must be of its community in two senses.

One of the senses is that the Learning Resources Center must be an integral part of community centers for health, work, government, leisure and worship. Is that a physical impossibility? No, not really!

An Education Machine or Mechanical Book, can have the central role in our Learning Resources Center 1980. This Education Machine will function much as today's libraries function. However, it will also be available to people at home as well as at the Learning Resources Center. It will only be at the Learning Resources Center that tutorial and/or counseling help will be available with the Education Machine. However, the Education Machine will itself be available to any qualified user who keeps his qualification valid by not getting into difficulty concerning which the machine recommends referral without further machine contact until duly re-authorized at a later time. Thus the physical location necessary will be that for a computing facility with supporting space for tutors and counselors. This should mean that integration of this space with that for health, government and worship should not be too difficult particularly because many of the informational operations associated with those functions will themselves be computerized by 1980. The association of the Learning Resources Center with facilities for work and leisure may be harder to accomplish than its association with functions of health, government, and worship. However, we do mean to stress the necessity that these functions of work and leisure *not* be permitted to be *fully* independent from those of education. It is the present separation of education from the functions of health, work, government, recreation, and worship which causes dysfunction in man's relation with his need for community largely because of the artificial difficulty of movement from one to the other.

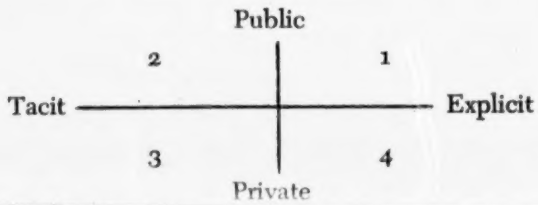
Learning Resources Center 1980 must therefore have arbitrary barriers in social structures reduced from their present levels which cause people not to experience a second or psychological sense of community. Learning Resources Center must foster a sense of individuality in every citizen but not at expense of a sense of community as well. However, in 1980, let's hope that the social sense of community can be interiorized as in the prior sub-section, not exteriorized as it largely is today among the alienated who speak of "our," not their, corrupt society. It will thus become a real part of identity, not a fact of alienation as is now said to be so dominantly the case. However, the psychological sense of community cannot be developed unless it evolves as a part of basic trust. In order for basic trust to have validity, access to community by way of health, work, government, leisure, and worship must all be available when man adopts at recurring moments in life the basic attitude of education, namely to come to know and to continue to want to know (Landy, 1968). The common good will have to have more emphasis along with an emphasis on individuality than *either* now receives if the necessary sense of psychological community is to be interiorized at all extensively.

Community resources which are truly organized in keeping with the needs of individuality—and thereby nurture that individuality to the generative level possible in potential for all—need in turn have no concern for healthier and sturdier communities. When individuality exists in generative form, a self-sustaining dynamic also exists; individuals help the community help individuals. Adaptation will thereby be moved upward in the scale of civilization to self expansion *for* self *and* others.

## THE TACIT DIMENSION AND EDUCATIONAL RESOURCES

As indicated to the admissions officer in particular, the primary task of an educator in general is to facilitate the assimilation of the known. However, as previously argued, an educator risks individual freedom and responsibility when he facilitates the assimilation of the known in ignorance of the processes of knowing.

Landy (1968) finds it convenient to conceive knowledge in relation both to public and private knowledge and, following Polanyi (1966), to explicit and tacit knowledge as well. Landy then proposes that these two dimensions be imagined to span a Cartesian space in which quadrants are numbered in the customary way, thus:



Landy first proves that knowledge exists in each of the four quadrants of the diagram. He then goes on to note that most knowledge today associated with education is in quadrant 1, the public and explicit quadrant. However, Landy argues as does Polanyi that tacit and private knowledge of quadrant 3 is interiorized knowing which is of as much importance to educational interests as is public and explicit knowledge. In fact, Richards (1955, 1968) argues that it is the potential feedforward inherent in private and tacit knowledge which actually provides the directional origin and motivational basis for knowing, the self-sustaining drive for effective curiosity.

The task of the educator is to help each student see and trust his tacit dimension. The processes and relationships inherent in education should in no way contradict the actuality and validity of tacit knowing. In fact, education should focus on *both* the explicit and the tacit dimensions of knowing; it should encourage the cultivation of tacit knowing; it should help a person to achieve a discourse appropriate to his tacit processes. In this way education can encourage a student to come to know and to continue to want to know, the only two valid criteria for education.

Tiedeman and Field (1965) have assessed the attention which we in the United States now give to tacit knowledge in education and personnel services. Their assessment finds such attention shamefully lacking, in fact almost nonexistent. Their assessment is in turn associated with recommendations to the Federal government for changing Guidance-in-schools into the profession of Guidance-in-society. The recommendations associated with that assessment indicate the many great changes in conceptions, attitudes, and support which will have to occur for the revised organization to exist. We shall therefore not again belabor those recommendations here. We merely assume for our purposes that they *have* been followed both in the United States and Canada and that the goal of cultivating the tacit dimension in every citizen is publicly accepted by 1980 in order that Learning Resources Center can in turn be organized so as best to realize the tacit dimension in every citizen is publicly accepted by 1980 in order that Learning Resources Center can in turn be organized so as best to realize the tacit dimension of man.

## THE EDUCATION MACHINE 1980

### INDIVIDUALIZING INSTRUCTION BY MEANS OF COMPUTER-ASSISTED INSTRUCTION

At the present moment, we are more or less accustomed to the fact that the computer can assist in instruction. We understand this assistance largely in terms of the presentation of material and of a computer response based in whether the student's prior response has been distinguished as right or wrong. We also understand that the computer can keep track of, or audit, right and wrong responses. This auditing can in turn be used to branch the student to parts of the instructional programs appropriate for his present understanding of a subject.

The computer is presently used in education largely to individualize instruction. By this is meant, the placing of a person in closer juxtaposition, more frequently and more consistently, with textual material considered appropriate for his present understanding. The appropriateness of this public and explicit material for present understanding is judged in terms of the rate of wrong responses he is making to queries at one level or another of the subject he is studying. In general, computer-assisted instructional programs keep a person at a level until he or the program moves to a more advanced level or until the subject is inferred to be making mistakes at his present level of study at the rate of about 1 or 2 questions in every 10. When this latter inference is made computer-assisted instructional programs then place the person with material at a presumably lower level.

Do not confuse the individualization of instruction in the above sense in which it is developed by a so-called Teaching Machine with the cultivation of individuality as it might be developed by what might be called an Education Machine or Mechanical Book. The cultivation of individuality is a higher goal in education than is drill and practice leading to knowledge assimilated in only public and explicit terms.

Although the construction of an Education Machine or Mechanical Book which will cultivate individuality is a difficult task, it is not an impossible task. At the present time, the United States Office of Education is supporting a project in which a prototype

Information System for Vocational Decisions (ISVD) is under construction. An ISVD is basically a Career Machine; a Mechanical Book for the realization of purpose in career development. However, it is now almost possible to turn the ISVD Career Machine readily into an Education Machine. This is an assertion of considerable importance for the creditability of our 1980 Learning Resources Center. Therefore, we indicate more specifically what the ISVD Career Machine will actually be like and do and how the conversion to an Education Machine might then occur.

## A CAREER MACHINE: THE INFORMATION SYSTEM FOR VOCATIONAL DECISIONS[2]

The Information System for Vocational Decisions will have, as integral parts, three primary files, each devoted to a particular type of information or data; educational, vocational, and military. This information will be arranged in such a way that the user may go as he wants to do so from a general review to a more specific focus, at which level he can begin to weigh various alternatives. As he searches on he will be able to clarify his ideas until he makes a choice, either one of the alternatives or further exploration.

While the user is exploring and clarifying his ideas regarding career possibilities, he will have opportunities to learn concepts from career, self-concept, decision-making, and other psychological areas. He will also receive instruction in the use of the data files.

A decision game will be employed to help the individual recognize areas of conflict in personal characteristics and future alternatives for education, work, leisure, and family. To play the game he can use the data of someone else's life, or that of his own. If he uses that of his own, two additional files will be required. One will contain his past and current educational and psychological characteristics. The other will allow the individual to compare his characteristics with those of persons who have achieved success in particular areas and whose records are also in the file.

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[2] This is an abstract of "The Role of Decision-Making in Information Generation: An Emerging New Potential in Guidance," ISVD Project Report No. 12, February 1968 which Tiedeman wrote. The abstract was prepared by the Editors, CAPS *Capsule*, Ann Arbor, Michigan, Counseling and Personnel Services Information Center, University of Michigan. The abstract is published in Vol. 1, No. 3 of the *Capsule*, pp. 1, 10, June 1968.

A third type of file will store the person's summary statements requested after each decision, as well as his career-concept as it has evolved from his review, exploration, and clarification processes as he used the data file. This will also serve to point up any lack of congruency. To aid still further in this process of weighing personal attributes and decisions, the O'Mahoney (1968) method of relating self impressions to work by means of the paired comparison of ambiguously pictured work situations will be used to provide a clearer understanding of the inquirer's actual and ideal selves.

As in any information system access to the ISVD data files will depend on various index terms and links between the files and the cross-referencing of categories from file to file. Such categorical and connective terminology will be developed as indicated in the third sub-section, from vocational-development, vocational-maturity, and agency-development theories. These three areas will be used as in the Tiedeman-O'Hara (1963) paradigm of decision-making.

The ISVD will be programmed to monitor or assess the quality of the decisions that are based on the material in the data files. This same monitoring process can provide the user of the System with information regarding how abstracts and the thesaurus of index terms are generated. With this knowledge, he can use the information collected during his review of the data files to construct his own thesaurus of terminology and to go on and process the information. A small, personal, esoteric information system is thereby created because it has also become an explicit part of the individual. The individual has succeeded in moving private and tacit knowledge into the explicit realm which could also be public if he elected to make it so. If the process is truly to be completed, the monitoring system within the person makes him aware that language and experience never perfectly correspond—that paradoxically, his understanding of his actions and experience cannot be perfectly construed. Perforce then, the individual learns that he must generalize when expressing and interpreting to others.

Generalization also must occur when the individual converts the learning that takes place in a simulated situation to real life experiences. The counselor, using his own interaction with the client and drawing upon his skill in assessing creative processes, becomes the first agent of generalization. Using this same assessing skill but focusing on the substance of the individual's situational role obligation, a military, school, or work supervisor becomes the second agent of generalization.

The ultimate agent of generalization is the individual himself. From weakness and incongruencies that become apparent in the simulated situation, he gains realization of the knowledge and lack of knowledge in his personal guidance system and the consequences on his life.

The ISVD can therefore provide the series of "dress rehearsals" which a person needs in career in order to achieve realization of self processes in the choice processes of career. Each "dress rehearsal" represents an imposed opportunity to make errors in the abstract before they become fatal. However, the proposed relationships between the inquirer and both the counselor and the supervisor represent an additionally imposed opportunity to insure that "the play goes on." The abstract must be brought into action. The ISVD Career Machine therefore constitutes the "instrument" (Richards, 1955) required to bring the tacit over into the explicit quadrants of knowledge. However, the human relationships also implicit in the ISVD career theory further insure that the explicit is brought from the realm of thought into the realm of action as well.

## AN EDUCATION MACHINE

The Education Machine or Mechanical Book will be constructed along the lines of the Career Machine. The attitude expected of the Education Machine's user will be that of inquiry. The basic files of the Education Machine will be those of subjects, not just that of career. The monitoring of the Education Machine will be programmed to deal with the elements of individuality which the inquirer can be expected to exhibit while addressing the assimilation of a subject's structure as programmed in 1) its basic files, 2) the game-like context in which it can be reasoned with, 3) the specific contexts in which the inquirer elects to use the subject in creating his esoteric form of it, and 4) misconceptions expected during assimilation.

The basic learning in the Education Machine will be the same as in the Career Machine, namely that language and experience never perfectly correspond. This realization will come in the Education Machine in the person's experience with the subject he is attempting to assimilate; in the Career Machine, with his career he is attempting to understand and gain personal control of.

As with the Career Machine, generalization must occur when the individual converts the learning that takes place in a simulated situation into real life experience. However, in the case of the Education Machine, a tutor, not a counselor, must use his interaction with the student and his skill in assessing creative processes in his subject to facilitate this generalization. Using this same assessing skill but focusing on the substance of the individual's situational role obligations, the work supervisor, clergyman, and/or family member becomes the second agent of generalization in conjunction with the Education Machine and the tutor.

The ultimate agent of generalization is the individual himself in the Education Machine as in the Career Machine. From weakness and incongruencies that become apparent in the simulated situation he gains expanding realization of the knowledge and lack of knowledge in his education and the consequences of both on his life.

As was the case with the Career Machine, the Education Machine will therefore also provide the series of "dress rehearsals" which a person needs in order to achieve realization of self processes in the choice processes of any subject. Each "dress rehearsal" represents an imposed opportunity to make errors in the abstract before they become fatal. However, the proposed relationship between the inquirer and both the counselor and tutor represent an additionally imposed opportunity to insure that "the play goes on."

## CAREER RESOURCES AND THE LEARNING RESOURCES CENTER

The section on the Career Machine specifies the reasoning processes involved in career development which should be a part of everyone's education. However, there are vocational and social skills involved in career which also require attention and cultivation.

Today's vocational literature abounds with advice that a person will in the future have not one but many jobs in his life. In the future, a person must therefore have not just an *occupation*; he must have a *vocation*. As Morley and Tiedeman (1966) have written, *vocation is an individually derived theory of employment which lends continuity to a person's several occupations and many jobs as he thinks about both together*. There are many implications of such personal knowledge for the secondary educator, particularly the vocational educator. Some of these implications were recently pointed out by Gross (1966) who advocates that the study of social and personal skills be incorporated into the curriculum in a modernized vocational education. These implications are also appearing in some of the better projects organized under terms of the Manpower Development and Training Act. In these better MDTA projects, education in social and personal skills accompanies education in work skills. By the above definition, education in social and personal skills is a part of vocation. Hence it should also be construed as a part of an improved vocational education. This is the first assumption underlying this effort to bring a new potential in career education into secondary education.

A person who both knows how to work and how to operate in the social and personal environment of work has acquired the theory of a vocation as Morley and Tiedeman define that theory. He is also well on his way to understanding both the personal and *common good* which is a part of the individuality sought in our 1980 secondary education. However, there is still a more highly developed form of vocational capacity, namely career competence. Career competence represents for work the actual individuality which ISVD seeks. *A career is both a sequence of jobs linked in the continuity of personality by the person, a* *vocation in short, and a sense of one's responsibility and initiative in that vocation.*

The sense of personal responsibility and initiative in one's vocation as defined is not readily attained. In fact, it is a lifetime attainment which is always in flux, never complete. Nevertheless, the *feeling* that one is in control is a natural feeling capable of awareness. It is man's singular characteristic of his humanness.

There are two elements of this *feeling* of being in control which are extremely relevant to career capacity or career development. One of the elements is the objects, ideas, or goals themselves which one controls. This element arises internally as feedforward (Richards, 1968). *Feedforward is that existing but unarticulated sense of something you are trying to bring into being,* a poem in the making, a new development, a vocation, or simply your present understanding of what we hope is now at least a vague idea of yours, not just ours alone. The second element of the feeling of control which is relevant in career development is the sense of responsibility and initiative one feels *toward himself and others* as he works to articulate his feedforward. It is this sense of responsibility and initiative *for* one's vocation, or *a sense of agency* which is the prime subject of guidance and psychological services in our 1980 Learning Resources Center. An effectively functioning sense of agency in each citizen will bring us to a new level of existence, a level in which individuality functions for personal *and* common good.

## IDENTITY AND THE LEARNING RESOURCES CENTER

### ADOLESCENCE AND IDENTITY

Erikson (1959) fixes the crisis of identity in the adolescent period. This is why we chose the period of adolescence as the lower bound for secondary education in our 1980 Learning Resources Center.

Adolescence brings with it many bodily changes which find expression in the socio-psychology of the person as he educates himself. It is a period when the adolescent strives to find and to assume a position in life which he wants. The outlined Education Machine contributes to the ideological growth which grounds and determines identity during the period. The also outlined Career Machine grounds this burgeoning ideological identity in the dimensions of job, occupation, vocation, and career. The career skills which have also been described add the social context in which identity forms. However, the Learning Resources Center must rely upon interactions with people to round out the emerging identity in adolescence.

### A SENSE OF AGENCY IN CAREER AND A SENSE OF IDENTIFICATION

Every citizen must actually achieve this higher level of individuality in our progressing civilization. The ISVD Career Machine set in the context for career skills in Learning Resources Center 1980 holds promise of permitting achievement of this aim. However, integration of community resources for the common good, individualization of instruction, and education for individuality must all be tempered in the fostering of identification, the fundament of identity.

The society of Learning Resources Center 1980 will be without many of the overt structures in which we were raised and have so far raised our children. These overt structures have furnished guides for social expectations, models to be envied, and pathways for entry and progress. Learning Resources Center 1980 will attempt to move these structures from external to internal bases. The ISVD Career Machine will attempt to do this by providing an overt linguistic framework within which each person can know the balance of authority of form and of experience which he creates for himself and uses as his cue for satisfaction in acting responsibly while striving. The Education Machine will generalize this effect in other subjects. However, the primary difficulty will then move from one of present feeling of cramped opportunity to one of future feeling of missing limits. There will be too little societally built-in feedback provided by fulfilling the expectations of others.

The Teaching Machine in the image of present kinds of computer-aided instruction will furnish one set of limits for expected form in experience. The Career Machine and its companion Education Machine will set other kinds of limits, particularly those having to do with the origination of intention and the evaluation of progress in intention. Finally counselor and tutor will be models and cultivate generalization of purposeful action in all realms of living. However, Learning Resources Center 1980 will additionally have to foster all kinds of contact of students with persons whom they may be attempting to emulate, initially probably unconsciously. This contact could first be in the form of vivid sound movies and the like. The contact can then be further augmented by the provision of game-like conditions in which acts can be undertaken and in which consequences can be experienced seriously but without real harm. But simulated experience will have to give way to real experience as quickly as possible in order for the authority of experience to have adequate play in balancing a person's authority of form as he strives. This requirement then merely underscores the already stated need for setting the Learning Resources Center into the entire set of services in its community. This is the way that models of envy, simulation, and excellence can be shared both with adolescents who are aspiring to do and with adults who are seeking new careers.

## LEARNING IN EXPERIENCING

Identity is ultimately forged in the crucible of action. It is in action that the individual is both ultimately himself and subject to the evaluations of that self by others, others to be sure who have come to mean much to him, to paraphrase Erikson (1959).

These facts provide additional reasons why secondary education should take place in a Learning Resources Center, not in a school. A Learning Resources Center offers the flexibility required for a pedagogy based in a learning of experiencing, not in a learning of telling. As long as there are figures for identification, facts which can be turned into information in the crucible of action, and expectations for excellence, we need have no fear that Learning Resources Center 1980 will continue the knowledge of our civilization. Instead we can derive hope that learning will also more regularly become a living part of a person's personality, that career can become personally determined, not externally imposed, and that life can be based as much in satisfaction as in success, a balance right now hardly ever even considered. Individuality will become more of a universal reality. However, it will be an individuality based in mutuality, not in selfish independence.

### OTHER CAREERS

We have specified that 1980 secondary education was for adolescents if they progressed into it without a needed period of moratorium and for adults who needed an education based in other or additional social as well as ideological development. We trust that the discussion of identity above makes it clear why secondary education for identity is as appropriate for adults starting other careers as for adolescents starting their first careers. The context of individualized instruction by way of the Teaching Machine, of the Career and Education Machines, of career skills, and of a community of service for a sense of community in service is the context creating additional as well as initial careers. These are the conditions in which identities are born and nursed until healthy enough to exist independently.

## MENTAL HEALTH, EDUCATION AND THE TREATMENT OF MENTAL ILLNESS 1980

### PSYCHOLOGY AND MENTAL ILLNESS 1980

Mental illness cannot be exactly estimated, because definitions and understanding are both highly amorphous. Nevertheless, at the present time, a rate of about 1 mentally-ill person in every 10 persons is ordinarily accepted as a reasonable rule of thumb. We have no reason to assume that this rate will dwindle, even with our Learning Resources Center 1980. Hence, let's plan pessimistically expecting mental illness at this high rate, thereby not blinding ourselves to its probable continuing existence.

It is a moot point as to where the locus of mental illness rests. There is clear evidence that the psychogenic hypothesis concerning the confused mental state holds in a substantial fraction of cases of mental illness. However, there is also growing evidence that blood changes are at least associated with, and may even be causing or be caused by, severe psychotic states. For this latter reason, chemotherapy for mental illness should be expected to be in a highly advanced state by 1980. This will mean that the psychologist in our Learning Resources Center will either have to be trained better in medicine himself or to rely more heavily on the community resources in medicine. He can do the latter if health and education are joint functions in a community center in which our Learning Resources Center exists.

Among those cases of mental illness in which the psychogenic hypothesis seemingly still holds good, there is also growing evidence that the confused mental state is grounded in a person's family, society, and culture as much as in himself. These realizations are giving rise to new forms of social treatment which focus upon the community and the healthfulness of its climate as resources in curing mental illness.

The new social treatment of mental illness is taking two major lines in its present development. On the one hand, electronic monitoring devices are being placed in the body or on the person of a mentally ill patient. Such a patient is then permitted to roam his community while his psychological state is being continuously monitored at a central receiving center. This treatment permits a patient to live a somewhat more normal life until an acute psychological episode becomes somewhat imminent, in which event he is warned to hospitalize himself or is brought into hospitalization if for any reason he cannot do so or refuses to heed the warning.

The second direction which the new social treatment is taking leads to the encouragement of sociability, further education, and employment. This form of treatment recognizes that health is predicated on coping ability in human relationships and on economic independence.

Both of these lines of social treatment are likely to expand and to improve between now and 1980. Therefore, the psychologist in the Learning Resources Center of secondary education 1980 might well be intimately involved with electronic monitoring of students' psychological states in its medical wing and with secondary prevention of mental illness through both education and employment counseling along with its Career Machine. The psychologist engaged in educational rehabilitation of the mentally ill students will also probably find himself needing to use behavioral therapy as a technique. This behavioral therapy cannot of course engender the desired individuality; it can only create conditions in which individual choosing once again becomes somewhat more possible. Therefore, since the use of behavioral therapy is essentially *anti*thetical to the sense of individuality Learning Resources Center 1980 is attempting to create, we must limit its use to extreme cases and continuously attempt to minimize the risk that re-attainment of the necessary curiosity which underlies choosing is then erroneously accepted by the person helped as the actuality of choosing.

## PSYCHOLOGY, GUIDANCE, EDUCATION, AND MENTAL HEALTH IN THE LEARNING RESOURCES CENTER

The mentally ill will be educated in the Learning Resources Center to the extent that their confused mental conditions permit education at any given moment. However, as Tiedeman has argued (1961), the primary prevention of mental illness requires an educational, not a medical stance.

The guidance activities outlined in conjunction with the cultivation of career and of a sense of agency in learning foster mental health in Learning Resources Center 1980. The services provided by a counselor in such primary prevention of mental illness and those therapeutic activities of the psychologist undertaken in interest of secondary prevention of mental illness are both based in the functioning of the ego. However, the psychologist is primarily involved in the reconstruction of belief in one's own curiosity which is required if choice is to take place at all. The counselor for his part is involved with that same curiosity at the time when the structures of choice are actually being formed, within it. Furthermore, the counselor is involved in bringing into awareness the fact that choice is and should be taking place.

These conditions underscore the necessary joint reliance of psychology and guidance on ego processes. It also suggests that the two are intimately associated by their common interest in curiosity and choice processes. However, therapy in mental illness makes education possible. The cultivation of purposeful action in counseling makes education effective. Therefore both psychological and guidance services will be present in Learning Resources Center 1980. Both counselor and psychologist can do the same things in that Center so long as each also does the distinctive things dictated by differentiated conditions. However, the presence of the Education Machine or Mechanical Book and its supporting tutor will round out the triumvirate of functions necessary not only to educate and to make education effective, but also to make education contribute in the expansion of our civilization.

# III. Work Organization and Accomplishments

## WORK ORGANIZATION DURING 1966-67

The first section outlined the theory of the Information System for Vocational Decisions during 1966-67. The actual project activities in that year were not yet fully consonant with the dictates of theory because accomplishments were not yet sufficiently mature. For this reason we conducted the initial work of the ISVD during its first year of operation in accord with three broad areas, each of which consists of two related sub-areas.

The first broad area as outlined in Section I, is concerned with *the development of a computer-based data system for vocational decision-making*. The first related sub-area consists of *the collection of data on education, training, and job characteristics and opportunities, and on the persons who will use the System.* (These data are initially only first approximations of the kind eventually to be developed.) This aim was achieved during the first year of work in the following Areas of the project:

Forecasting Area
Placement Area
Information Area
Inquirer Characteristic Area
Data Files Area
  (1) Occupational
  (2) Military
  (3) Educational
  (4) Personal and Family Living
  (5) Inquirer Characteristics

The second related sub-area calls for the *development of computer routines (computer programs) and utilization or adaptation of display devices (audio, video, tape, cartoon, film, etc.) which will connect the user, in terms of his personal characteristics, directly with the data so that he can generate information for his use in vocational decision-making.* This aim was pursued during the first year of the project through work in the Computer Area.

The second broad area of the project concerns itself with *the development of a training program, or course in vocational decision-making.* One part of this task called for the *specification and provision of the elements and process of decision-making for individuals of various ages and vocational situations.* This task was pursued during the project's first year through work in the following areas:

Decision-Making Area
Vocational Development Curriculum Area
General Curriculum Area
Psychological Curriculum Area.

A second, but related, task is that of *supervised practice in decision-making for inquirers and counselors, using the computer-based data and routines.* This activity was necessarily given secondary emphasis during the first year of the project. These aims were focused in the project through work in the following areas:

Educational Organization and Supervision Area
Reporting and Education Area

The third and final broad area of the project deals with the *study and assessment of the System, its users, and its use.* Since a computer-based system was not yet constructed, very little work was conducted in this Area during 1966-67.

## WORK ORGANIZATION DURING 1967-69

The crystallization of the theory underlying the organization of Prototype I for the ISVD as theoretically outlined in the second section of this Report, led to revision of the areas within which the activities of the project are best organized. Therefore, rather than organizing activities according to the categories listed in the First Annual Report, the Second Annual Report and the present Third Annual Report organizes activities according to the following four main areas and associated sub-areas.

The first main area is that of preparation of *primary* data for computer control of presentation. This includes assembly, organization and filing of *primary* data in each of the following areas:

Forecasting
Occupational and Placement Alternatives
Military Alternatives
Educational and Admission Alternatives
Family Living

An additional sub-area of activity is computer control of presentation of this material.

The second main area is concerned with decision-making and the generation of information through coordination of *secondary* data files, computer processing, and personal activities. Both instruction in decision-making and practice in decision-making by means of games are coordinated with *primary* data files.

Deciding and vocational development, and, deciding and agency development are coordinated through *secondary* data files. Also included in this second main area of activity is the computer control for processing of *secondary* data. An additional activity is that of counseling and supervision in the ISVD along with the required reorganization and re-education.

The third main division of activity is that of study and assessment of the System. Administration of the project comprises the fourth and final area of activity.

## ACTIVITIES

### *Activities: Preparation of* Primary *Data for Computer Control of Presentation*

#### *Assembly, Organization and Filing of Primary Data*

## FORECASTING AND ASSOCIATED DATA FILE

### *Professional Personnel*

Russell Davis and Richard Durstine, Directors; Lynne Fitzhugh, Elizabeth Truesdell, Richard Truesdell, Laurence Wolff, and Patricia Yee

### *Summary*

The overall plan for assembling and making occupational forecasts available consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Develop methodology and assemble data |
| September—November 1967 | 2. Apply methods to data and establish classification for on-line use and updating |
| December 1967—February 1968 | 3. Establish operating system for Prototype I |
| March—June 1968 | 4. Implement 2 & 3 above for Prototype I |
| July—August 1968 | 5. Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 6. Implement Prototype II |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final Reporting |

The overall plan reached its Phase 6 during the year, and continues there due to delays in the field test. This data file will therefore not be field tested as called for in Phase 7. Instead specifications and basic data for it will be delivered, as noted in Phase 8.

Methodology and basic data for forecasts of occupational requirements at a local level are ready, based on the national forecasts developed earlier. Some general forecasts based on worker characteristics rather than on occupations or industries have also been developed and prepared for publication. An extensively cross-referenced bibliography of several hundred items has been completed.

## A FORECASTING DATAFILE BASED ON LOCAL DATA

The basic datafile on forecasting was developed as an adjunct to the datafile on occupational alternatives, making use of the methodology developed in 1966-67. This is now available for use by the working system. However, actual testing of these materials on-line has been delayed because of lack of appropriate console equipment, at the right time.

From the national forecasts, preparation of local forecasts was begun and carried to an advanced stage. The methodology is one that can be used for any part of the country for which suitable data are available. This uses a two-digit classification both for occupations and for industries. Local census figures are generally used for 1960. Estimates which might be available for the future, either for occupational employment or (more likely) for industrial employment, can be used as a local base for projections. Available local information will be put into a structure consistent with the national model as it has been developed. Gaps in the local information are then filled to give a local statement in the same form as the national statement.

Preparations have been made to try this for the Boston metropolitan area. This would give a tested means for building local forecasts, for use with a broad spectrum of kinds of local data. It would thus be possible both to develop and to present forecasts for various localities using a single methodology. High and low local estimates of employment by year would thus be available for some 2000 occupation-industry combinations, based on national data provided by the Bureau of Labor Statistics. Specifications and basic data for these forecasts will be included in the final reports and files of the Project.

## PROJECTION OF SKILLS

Forecasts of employment have been linked with requirements for individual jobs to give an estimate of the levels of skill, and other characteristics, that may be required in the United States labor force by 1975. This was based on a computer analysis of occupational forecasts by the Bureau of Labor Statistics, linked with the full range of titles of the *Dictionary of Occupational Titles.* Demand for aptitudes, temperaments, and training are included, both in terms of absolute demand and of rate of change of demand. A research paper has been prepared for publication based on this work.

#### BIBLIOGRAPHY FOR FORECASTING

A structured bibliography has been completed as base for future forecasting activities. Some 600 titles have been identified and classified according to key variables. These allow for addition of further titles as they become available, and for selective retrieval of references useful to forecasting.

## OCCUPATIONAL AND PLACEMENT ALTERNATIVES AND ASSOCIATED DATA AND FILES

### Occupational Alternatives and Associated Data File

#### *Professional Personnel*

Russell Davis and Richard Durstine, Directors; Lynne Fitzhugh and Richard Truesdell

#### *Summary*

The overall plan for constructing the occupational data file consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Survey needs, available systems and data. Assemble data. Experiment with models for data retrieval of occupational data file |
| September—November 1967 | 2. Construct and revise data file |
| December 1967—February 1968 | 3. Plan and do cross-referencing |
| March—June 1968 | 4. Implement 2 & 3 above for Prototype I |

| | |
|---|---|
| July—August 1968 | 5. Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 6. Implement Prototype II file |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final Reporting |

The overall plan for constructing and using the occupational data file called for the file to reach its Phase 8. This has been achieved. A final report will be forthcoming soon.

Preparation and use of occupational data continued as planned and reported in earlier reports. For the most part this work reached advanced stages of implementation and was field tested. A data file on information relating to occupational groups also continued under preparation.

### THE DATA FILE

Treatment of occupational alternatives centers around a file of some 850 titles. This information has been augmented by specialized information from the *Dictionary of Occupational Titles* (D.O.T.) and by selected material from the *United States Census of 1960*. Of central importance is a capability to coordinate and present these varied pieces of information in an effective way. This has included: means for access to and presentation of the various parts of the occupational data file; collection of these parts into a working whole; articulation with information of related topics. This file, which with its means for access and presentation was prepared some time ago, has been included in the working system for its Field Test phases.

### A SECOND OCCUPATIONAL DATA FILE

A second datafile of occupational information, based on 165 occupational groups, is in advanced stages of development. It includes information taken from the United States Census of 1960 plus the national occupational forecasts developed earlier and described under "Forecasting." Also included are links to information about individual job titles and about enlisted jobs in the military. Procedures for rendering the datafile into English sentences have been prepared. Relationships of this to other data files, and to methods of choosing information (e.g. categories by Anne Roe and Project TALENT) could readily be developed later, as extensions of this file.

## Library of Occupational Facts

### *Professional Personnel*

Roger Brown and Edward Landy, Directors; Wallace Fletcher, and Dorothy Kunberger

### *Summary*

The overall plan for library assembly and use consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Assemble, classify, and make available occupational information in Career Resources Center |
| September 1967—May 1969 | 2. Update information as necessary |
| September 1967—February 1968 | 3. Use information in Prototype I both as scripts themselves and as reference material supporting script purposes |
| March—June 1968 | 4. Implement 3 above for Prototype I |
| July—August 1968 | 5. Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 6. Implement Prototype II |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final Reporting |

The overall plan called for the library to reach its Phase 8 which it did. A report is now available.

### MATERIAL ACQUISITION AND UP-DATING

During 1968-69, the occupational information library at Newton High School was updated through Newton School Department funds. Ultimately, the entire funding of the Career Resource Center will be assumed by the Newton Schools.

Students, teachers, counselors, and outside professional people visited the library during the year and made frequent use of its abundant materials. Likewise, the library material and equipment were especially useful to the students who were working directly with the ISVD console which was located in the Career Resource Center.

### BIBLIOGRAPHIC RETRIEVAL

The entire bibliography of materials was printed during the Eighth Quarter in a book, *The Career Information Service: A Guide to Its Development and Use.* This book is currently available for a small fee from the Bureau of Vocational Education of the Massachusetts Department of Education, 182 Tremont St., Boston, Mass. 02111.

Eventually, the students can be branched from scripts on occupations to a listing of the related materials available in the Center's library.

## Placement and Career Resources Centers

### *Professional Personnel*

Roger Brown and David Archibald, Directors; Allan Ellis, Edward Landy, Sheila Leahy, T. J. O'Mahoney, and Myra Trachtenberg

### *Summary*

The overall plan for placement and career resource centers consists of the following general phases:

| | |
|---|---|
| June 1966—May 1969 | 1. Establish placement and career resources centers in |

| | | |
|---|---|---|
| | | high school, college, graduate school, and employment institutions. Plan for computer activities in placement |
| September 1967—March 1968 | 2. | Prepare placement activities for computer in relation to Prototype I |
| April—June 1968 | 3. | Implement materials from 1 and 2 for Prototype I |
| July—August 1968 | 4. | Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 5. | Implement Prototype II |
| April—June 1969 | 6. | Field test Prototype II |
| July 1969—June 1970 | 7. | Final Reporting |

The overall plan for Career Resources Centers called for both to be in Phase 7 at this time. The Newton Center was; the Harvard Graduate School of Education Center only reached Phase 5.

## PLACEMENT AND CAREER RESOURCE CENTER

During 1968-69, over 600 students from Newton High School visited its Career Resources Center. A great majority of them returned to the Center to look at audio-visual materials, books, and pamphlets; talk with the counselor at the Center about their career or college questions and plans; take a Kuder Preference Record or Strong Vocational Interest Test; or search for information about the jobs available to them, either full or part time, under Jobs For Youth.

During the school year, over 1000 pamphlets and over 400 books were taken from the Center on loan by the students and teachers. Actually, this was well over a 400% increase in circulation when compared to the last school year.

Several conferences were held for students at which they could talk with persons employed in various occupations. For instance, a stewardess, a pilot, and a mechanic talked with interested students about career possibilities in the airline industry.

## JOBS FOR YOUTH

This year about 600 jobs with over 150 companies were located, and notices of the openings were made available to the students at the two high schools and the junior college. The "peak" periods for new listings were the Christmas and pre-summer vacations. A number of the listed job openings were for terminal students, especially in companies which wished to train them during the summer for permanent employment. It is expected that this activity will be able to be continued next year.

## HGSE PLACEMENT DATA FILE

A data file using information available at the HGSE Placement office was brought to the implementation stage and then deferred for other computer-time priorities. At present, there are cards and documentation for 500 positions in about 285 schools and colleges in the U.S., Canada, and the Virgin Islands. Most are teaching positions, of which approximately 200 are at the college level and 300 are at the elementary and secondary levels. Positions such as guidance counselor and reading specialist were given some priority, for their high level of interest to graduate students in the field of education who were expected to use ISVD in its field test. Other positions included were of an administrative nature.

The variables that were finally included in this demonstration package include the employer name and address, position type and level, the academic field in which the position is located (space for two), the specific title of the position, the lowest and highest yearly salary offered, the minimum years of experience desired (teaching, administrative, and other); minimum education required, and the month, day and year the vacancy opens, as well as the normal teaching load in hours per week, if available, and the name of the person to contact for an interview. Benefits available, such as Blue Cross, room and board, travel expenses, and specific additional information regarding salaries was also included for those positions listing such information.

The Level I records were coded as were all the lists, and the preference script (a short one) was written based on the following categories: type of position, level of position, geographical area, and subject matter. An attempt was made to distribute the positions geographically, with emphasis on the New England area. The template was written and coded, and links to other parts of the system proposed, but further implementation was deferred indefinitely.

### RESUMES

The "implementation gap"—the hiatus between the system-bound, "as if" activities and the real-life tasks of actually locating, applying for and securing a job position—is further closed by a script dealing with the preparation of a resume and its use as a tool in getting a job.

Because the ISVD system implementation was itself slowed down during 1968-69, it was decided that this script could be presented as a booklet, not as an operating procedure. Consequently the booklet "Getting a Job: Writing and Using Resumes" was made available to inquirers in high school and WEMBROC during trial implementation.

It was not our intention to develop a resume service, but some discussion of the possible uses of the booklet as a resource in the system did occur. One suggestion was that a programmed version could be used which would serve as a coordinating and integrating device whereby Preference Script data and materials resulting from EXPLORATION, CLARIFICATION, REVIEW and ANALYZE routines, as well as the Self Assessment procedures, could be brought together. Also, a "resume routine" could be utilized as an alternative jump-off point from which an inquirer selectively accesses the system and to which he could return when he desires to do so. The resulting loosely-defined resume would thus effectively be a combined personal characteristics, self assessment and cumulative record which could be included in the inquirer's personal data file and may later prove useful in preparing a resume-proper (with a possible print out capability), and might also serve to link into a placement facility.

## MILITARY ALTERNATIVES AND ASSOCIATED DATAFILE

### *Professional Personnel*

Russell Davis and Richard Durstine, Directors; Patricia Yee

### *Summary*

The overall plan for constructing the military datafile consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Survey needs, available systems and data. Assemble data. Experiment with models for data retrieval |
| September—November 1967 | 2. Construct datafile |
| December 1967—February 1968 | 3. Plan and do cross-referencing required among datafiles |
| March—June 1968 | 4. Implement 2 & 3 above for Prototype I |
| July—August 1968 | 5. Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 6. Implement Prototype II file |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final Reporting |

Work in this sub-area, the earliest in which information was ready for operational use, still was brought only to its Phase 6 during the year. Because of other higher priorities it was not possible to bring this file into operation during the field test. Therefore Phase 7 for this area could not be realized, but the implemented datafile will be included with the final reports and files of the Project as called for in Phase 8.

## THE MILITARY DATAFILE

Basic information about officers' and enlisted careers in the Army, Navy, and Air Force has been coded. One hundred and seventy enlisted titles are included, as are a substantially smaller number for officers, where career lines are not so distinct. Concurrent with this coding of information was preparation of an English-language format for its presentation, and provision for entry to the information through the inquirer's responses to a programmed set of questions.

The military datafile was fully complete on paper at an early date, and has received priority treatment as a part of the operating computer system. The military data base material has been implemented into the system. The associated officer and enlisted category concept scripts have been translated into GLURP for compilation on the computer.

## EDUCATIONAL AND ADMISSIONS ALTERNATIVES AND ASSOCIATED DATA FILES

### *Professional Personnel*

Robert O'Hara, Director; Robert Aylmer, Richard Durstine, Allan Ellis, Marietta Haley, Thomas Hutchinson, Dorothy Kunberger, Priscilla Little, and Patricia Yee

### *Summary*

The overall plan for constructing the education data file consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Survey of needs and available systems |
| September—November 1967 | 2. Plan for implementing of college file, trade school, high school and junior high school files |
| December 1967—February 1968 | 3. Plan and do cross-referencing required among data files |
| March—June 1968 | 4. Implement 2 and 3 above for Prototype I |

| | |
|---|---|
| July—August 1968 | 5. Do restricted field testing of Prototype I to develop specification modifications for Prototype I |
| September 1968—March 1969 | 6. Implement Prototype II files |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final reporting |

During this third year four educational data files and associated scripts were brought to completion as called for in Phase 7. A description of each of these is given below. Final reports are now being prepared.

## COLLEGE DATA FILE

The college data file has been completed and the file has been implemented. The college data file includes some 80 variables covering such items as the name and address of the school, the year it was founded, the type of housing provided, its religious or state affiliation, if any, the number of undergraduates, the focus of the college (whether Liberal Arts, Teacher Preparation, Professional, Technical, Agricultural, Fine Arts, or a University), the level of preparation that may be attained at the school, the entrance exams required, the application dates and fee and its due date, whether freshmen may be admitted in January, its accreditation, the fees per year for room and board, tuition and other fees, scholarship information including deadlines for application and percent of student body receiving scholarship aid, as well as the total number and amount of scholarships awarded in the source year, and the average amount of freshman scholarships. The same type of information is given for student loans, and information is also given about the percent of students working to earn a part of their expenses. Other undergraduate divisions of a university are listed in addition to liberal arts. The date of candidate notification is included, as well as whether the college subscribes to Candidates Early Reply Data Agreement, and whether the notification is on a rolling basis or not. Geographical location, such as number of miles from the nearest large city and the nearest city's name, and what kind of transportation is available to the college, is also given. Whether or not the college has a Phi Beta Kappa chapter is noted, as are the availability of such services as French House, Junior Year Abroad, Language Laboratories, Honors Programs, Independent Study, Senior Comprehensive or General Exams, Interdepartmental Programs, preprofessional programs, military ROTC programs, and the number of volumes in the library. In addition, the counseling services were coded; the availability of guidance facilities, a placement office, a testing office, a counseling service, or a guidance center, can be determined as well as the availability of Faculty advisors, residence counselors, and other guidance facilities. Athletics—both intercollegiate and intramural—were coded. The type of academic calendar—semester or trimester or other—was coded, as well as whether or not the college has an early decision program and/or an advanced placement program. Social organizations and extracurricular activities were also searched for and coded, including fraternities and sororities, student association or government, student newspaper, student literary magazine and other student magazines, yearbook, glee club, choir, band, orchestra, debating, dramatics, a radio station, and other extracurricular activities and special programs, such as semester in New York or Florence. Transfer information, including the dates transferring students could be admitted and the grade average required for transfer, was coded. The number of freshmen in the class entering in fall, 1967 was coded, together with background information on them, such as their secondary school class rank and the percent of the class that were in that rank—for instance, "60% of our students were in the top ten percent of their class." The minimum number of required high school units was also coded, as was the number of years residence required and the rules regarding housing at the college. Finally, we included whether or not the college was a participant in the College Scholarship Service and/or the Federal Work-Study Program, the date by which the student must accept the college's offer of admissions and the deposit required to reserve a place in the class, together with the fact that it was refundable or not. The name, title and address of the person to be contacted for further information was the final information given, with plans to include the names of possible majors (space was left for up to 35 possible majors to be listed) as soon as we could implement a scheme for coding college majors that had already been developed by Walter King Gillen of IBM.

A template was devised that would give to the inquirer upon request all of the information available for a particular college. This included complete information for 171 colleges and more limited information—including name, address, control, year founded, student body, accreditation, level and type of offering, tuition and room and board, student aid, whether or not National Defense Loans were available, information about student housing and about applications and admissions tests—for about 187 more colleges. [The latter colleges were all located in the New England area. The others were chosen according to a percentage system linked to the percentages of Newton High School students who generally attend colleges in various areas of the country (see Newton Follow-Up Study Chart in *Career Information Service* by Duncan Circle, David Clemens, Arthur Kroll and Dorothea Overholt, Newton Public Schools, May 1968, pages 121-128).] The data base includes some colleges from each of the fifty states, and Canada. A second and shorter template was devised and implemented for the second set of colleges. The number of colleges actually coded and made available to the system was 358. Full information was coded for each of the twenty-three colleges preferred by Newton students, as designated in the Follow-Up Study.

After this, Level I records (a more general categorization of the information available) were prepared, for use with the College Preference Script. This list included such items as "New England Colleges," "Urban Location," "Rank in Secondary School Class of Present Freshmen: Top Fifth." Using these records, a preference script was written which included the following large categories: geographic location; private, public, or religious affiliation; sex of student body; type of program (for example, liberal arts or preprofessional); size of student body; availability of financial aid; urban, suburban, or rural environment; special courses of study; types of extracurricular activities available; academic standing of present freshmen; preferred college major available. All of these were able to be implemented, except for the last one, since the college majors possible had not been coded. As planned, the inquirer could choose any one or all of these categories and state the order of importance to him of any he chose. Using these preferences, colleges could be selected and a list displayed of those that most coincided with his interests. He could then request a template description for any of the colleges on the list.

Finally, a system of interacting scripts was proposed, using the scripts that had been written in the summer of 1967 (See chart on p. 158, Second Annual Report on ISVD). The scripts were edited and links provided between them and to other existing and new scripts. These have for the most part been implemented as shown in the flowchart of the final implementation of college scripts (See Appendix I).

### TRADE SCHOOL DATA FILE

Work in the trade school sub-area has been completed. There are data coded for approximately 140 schools in New England. The associated materials—direct access scripts, minor orientation script, preference scripts, and concept scripts—have been implemented.

The preference script consists of two versions, one for the first-time user and an abbreviated version for users after the first time through. Composed of ten questions, the script assesses the student's values in the areas of location, type of school curriculum, programs and facilities, tuition expense, financial aid, duration of program, living accommodations, student body composition, enrollment date, and educational plans.

There are concept scripts pertaining to commuting time; on-the-job training; living expenses; room and board costs; books, fees and supplies; meeting financial expenses; freedom and personal responsibilities; family and community activities; family relations and dormitory living; school activities and facilities; and general information.

## HIGH SCHOOL DATA FILE — NEWTON HIGH SCHOOL

The high school sub area consists of direct access routines and template descriptions of the tenth, eleventh, and twelfth grades.

The tenth grade template discusses general school information (location, buildings, student body and staff, special features, special services), the house plan, entrance requirements, courses, curricula, schedule, extra-curricular activities, student government, and tenth grade orientation. The eleventh grade template presents information about classification, credits for graduation, units for college admission, the college testing program, registration, requirements, programs of study, electives, and opportunities for recognition. Classification, credits for graduation, college tests, reports to colleges, senior activities, graduation, awards, and scholarships are the topics which comprise the twelfth grade description.

## JUNIOR HIGH SCHOOL DATA FILE — WARREN JUNIOR HIGH SCHOOL

Work in the junior high school area has been completed. The introductory orientation scripts, preference script, templates, direct access routines, and concept materials have been implemented.

The introductory orientation script presents the information about Warren Junior High School organized in list form for easy access by the student. The preference script elicits responses from the inquirer in the areas of club selection, eighth and ninth grade electives, and ninth grade programs of study.

The seventh grade template discusses general school information (location, facilities, staff, appointments, elementary schools represented, and size), schedule, lunch, transportation, orientation, subjects, report cards, extra-curricular activities, and student council. There are three general categories of information in the eighth grade description—first-day orientation, subjects, and extra-curricular activities. The topics of first-day hours, programs of study, college program, general business program, promotion requirements, ninth grade activities, and awards comprise the ninth grade template.

The concept scripts discuss homework, clubs, grade and achievement, courses, elective choices, guidance counselors, making new friends, responsibility in junior high, and making improvements.

## FAMILY LIVING AND ASSOCIATED DATA FILE

### *Professional Personnel*

Charles Gunnoe and David Tiedeman, Directors; Myra Gannaway, and Esther Wiedman

### *Summary*

The overall plan for constructing the family living data file consists of the following general phases:

| | |
|---|---|
| June 1966—November 1967 | 1. Survey of ISVD needs and available procedures |
| December 1967—August 1968 | 2. Plan and construct data file |
| September 1968—March 1969 | 3. Implement data file for Prototype I. Do restricted field testing of Prototype I to develop specification modifications for Prototype II. Implement Prototype II |
| April—June 1969 | 4. Field test Prototype II |
| July 1969—June 1970 | 5. Final reporting |

Because of other more urgent priorities, only phase 3 in the overall plan for this area was reached by July 1969 when the Field Test had to be terminated.

It was decided that existing data would be used whenever possible. Since the data used will have been analyzed and reported by existing agencies in the future, subsequent investigators can update and revise information projected for ISVD-like systems without bearing the financial burden of additional data collection.

While implementation of facts/data into computer programs was impossible, a later project report will fully describe the organizational strategies proposed for such development.

Previous quarterly and annual reports indicate the intended threefold structures for this data base: demographic statistics, cost of living statistics, and predictive family living statistics. Even limiting our focus to the area surrounding Metropolitan Boston, data exist for 118 communities (Massachusetts Department of Commerce and Development). For the areas of which these communities are a part, data have been collected by the United States Department of Labor Bureau of Labor Statistics (especially Survey of Consumer Expenditures). Given implementation of our computer programming techniques, it will later be possible for an inquirer to access facts/data concerning these 118 communities (each community having facts/data under 12 sub-categories: general information, population characteristics, historical points, housing, economic base, employment and payrolls, municipal finance, education, transportation, economic development, planning and utilities). Further, the inquirer could obtain facts/data about consumer expenditures and their forecasted values for these areas thus providing him with a base upon which to make not only immediate but also future decisions. The software technology which has been developed in the ISVD makes this type of inquirer access feasible when the above data file is constructed and joined with necessary preference and other scripts. The project's current experiments in content analysis may provide methods to enable even more efficiency and adaptability than proposed here.

### *Computer Control for Presentation of Primary Data*

*Professional Personnel*

Allan Ellis, Director; Thomas Hutchinson, Assistant Director; Roy Norris, Director of Systems Design; David Archibald, Toby Boyd, David Brewster, Susan Kaiser, Marjorie Madoff, Charles Roehrig, Richard Roman, Susan Roman, Arlene Scherer, Dorothy Swithenbank, Thomas Swithenbank, Heather Scott, Herbert Simons, Ann Taylor, Jeffrey Tiedeman, and Michael Tiedeman.

*Consultant*

Graham Smith

*Summary*

| | |
|---|---|
| June 1966—February 1967 | 1. Explore existing software and hardware |
| March—June 1967 | 2. Test and evaluate techniques uncovered in exploration |
| July—November 1967 | 3. Specify Prototype I (Computer) |
| December 1967—June 1968 | 4. Implement Prototype I |
| June—September 1968 | 5. Test and refine Prototype I |
| September—October 1968 | 6. Specify Prototype II (Computer) |
| October 1968—March 1969 | 7. Implement Prototype II (Guidance) |
| April—June 1969 | 8. Test and refine Prototype II |
| January 1969—June 1970 | 9. Specify Prototype III |

The third year of the ISVD project was, for the computer software division, one in which all the work of the previous two years was brought to bear on the problem of implementation; specifically phase 8 was to have been reached and it actually was. This implementation effort ran the gamut from systems programming to scriptwriting and data base creation. Here we discuss this activity under four headings: a) a checkpoint system; b) a field test system; c) a scriptwriting language; d) other software activity. Efforts under these categories resulted in the specification, implementation, and test and debugging of all computer software components of Prototypes I and II as promised in the original contract. These efforts also provided means whereby Prototype II of the guidance system could also be brought to Field Test but not debugged and made technologically reliable.

## CHECKPOINT SYSTEM

The major portion of our energies was directed, during the first few months of this last fiscal year, toward the completion of a working version of Prototype I computer systems software. We call this a checkpoint system because, in fact, partial implementation of Prototype I had existed throughout the latter part of the 1967-68 fiscal year. A point had to be reached where the system evolution represented the completion of Prototype I and the beginning of Prototype II. The checkpoint system represents this point. The following gives a general indication of the checkpoint system from the point of view of computer software capabilities.

a. The ability to operate the ISVD timesharing software system for one Sanders 720 video display terminal augmented by the Kodak CAPAL and hardcopy slave printer;
b. the ability to execute the ISVD scripts;
c. the facility for the retrieval of data both directly and via scripts;
d. the processing of level I records;
e. a phase one decomposition capability for the handling of English sentence input.

## A FIELD TEST SYSTEM

Transition from this checkpointed version of a system to that needed for the field test required in computer software such things as the ability to handle six terminal facilities, the ability to store data on-line and to process them later off-line, and the ability to execute the full range of scripts, which means that we had to operate the timesharing system with one primary and three secondary disc drives.

To be more specific about this, the following is a list of the major tasks which were accomplished and which led to our field test system:

— consolidation of version two of disc loader
— modification of Programs to handle decode tables to accommodate largest size expected
— completion of off-line data access and storage management system (DASM)
— the extension of HASM, the processing component of DASM

— the completion and modification of core resident DASM
— modification of off and on slot modules in BTSS
— the extension of TRAC to handle the storage of data through HASM and DASM
— the development of a disc file garbage collector
— the loading and testing of current data bases and scripts
— the development, extension, or completion of such off-line programs as a log tape processor, a script loading routine, and a copy disc-file routine.

## A SCRIPTWRITING LANGUAGE

ISVD is organized so that design of the computer and guidance systems proceeds apace but interactively to the extent that interaction can be arranged and maintained. In this regard the computer area originally offered the guidance design computer capability planned in MINORCA. Guidance personnel accepted this design and worked within it during the fifth through ninth quarters. During this time it became apparent that the capability originally planned for MINORCA needed augmentation by some of the capability inherent in ELIZA. The needed augmentation is now specified in a language dubbed GLURP.

GLURP stands for a Generalized Language for Understanding and Responding to People and was inspired by a number of languages, each of which possesses aspects of the overall capability needed in ISVD. Its ability to manipulate strings stems mostly from TRAC, the language developed by Calvin Mooers and Peter Deutsch, while its list processing capability is modelled after SLIP, created by Joseph Weizenbaum. Also from Weizenbaum's work, GLURP took the notion of sentence decomposition, recomposition, and those other features that constitute ELIZA. This provides substantial natural language processing capability. In addition, GLURP incorporates a refined version of MINORCA .5, an author language developed by the computer area of ISVD and content analysis features of Philip Stone's General Inquirer System. To all of this GLURP adds a command language for direct access to the data bases by the inquirer as well as certain other features which make it an excellent language for ISVD.

## OTHER SOFTWARE ACTIVITY

*Scripts.* Under the direction of Richard Roman, the Computer Area completed the considerable job of translating all of the ISVD script network into the computer language we call GLURP. This included all the various categories of scripts as well as the Life Career Game which was programmed mostly by David Archibald. Following this, the scripts were keypunched, edited, and made ready for preprocessing programs. As a result of this stage, scripts were re-edited principally to remove errors in programming syntax. Sets of scripts were then put on a test disc and runs made to make sure that our system was handling them properly. The final stage of script processing consisted of putting them all out on disc for final storage. The job of implementing scripts having been thus completed, we monitored their use during the field test to locate "bugs" and awkward sections which were then corrected or revised.

*Data.* The military, occupation, college, trade school, and inquirer data bases, with their associated slide data files, were processed and put onto disc. This task involved preprocessing of primary level records to get them in machine-usable form including the merging of two occupational files. In addition, programs were written to create for each of the substantive data bases the associated secondary level records. This completed, the space on the four-disc time-sharing system was allocated, and sample data put out for testing purposes. Subsequent to this phase, the data were put out for final storage for use in the field test.

*Programs.* Some of the major programming activities of the computer area are:

a. Completion of the software for linking the SANDERS 720 to the RCA machine along with the proper formatting of the CRT;
b. Extension to TRAC to accommodate the interrelationship among the software components of the system;

c. Extensions to GLURP to allow further decomposition and to permit a more efficient translation of scripts into GLURP;
d. The debugging of the set of batch programs for creation of the data bases;
e. The specification for a set of log tape processing routines to provide summary statistics and path analysis of inquirer use. Associated with this is further alteration to TRAC in order to write additional materials onto log tapes in a format to facilitate further processing;
f. Specifications for alterations to BTSS to accommodate the simultaneous use of six video display terminals on the system;
g. The implementation of TRAC functions in order to write additional materials on to log tapes;
h. Completion of alterations to BTSS to permit simultaneous use of up to six video terminals;
i. The development of programs to process the log tape;
j. The development and implementation of programs to maintain the ISVD disc packs.

## *Activities: Decision-making and the Generation of Information Through Coordination of* Secondary *Data Files, Computer Processing, and Personal Activities*

### *Decision-Making*

### INSTRUCTION IN DECISION-MAKING AND ITS COORDINATION WITH *Primary* DATA FILES

*Professional Personnel*

Robert O'Hara, Director; Dorothy Kunberger, Richard Roman, and Susan Roman

*Summary*

The overall plan for constructing scripts in decision-making was presented in the First Annual Report in two sub-sections: decision-making area; and vocational development area. In the Second Annual Report this aim of the sub-section was separated according to its function, namely instruction in decision-making and its coordination with *primary* data files.

The overall plan for constructing *instruction* in decision-making therefore presently consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Construct and field test decision-making booklet for junior high school. Specify behavioral goals and write necessary scripts |
| September—November 1967 | 2. Organize, winnow, and edit scripts |
| December 1967—February 1968 | 3. Revise scripts, add needed scripts, and provide scripting of interchanges among scripts as well as data assembly for MONITOR |
| March—June 1968 | 4. Implement 3 as Prototype I |
| July—August 1968 | 5. Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 6. Implement Prototype II |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final reporting |

During this past year, the set of scripts entitled "Self and Decision-Making" and the set entitled "Self Attributes and Deciding" were combined into one composite set. It was decided that the language and content of these scripts were more suitable for elementary school and junior high school than for older ages. They, therefore, became a part of the elementary school sub-system and were implemented on the computer with that decision in mind. Further development of the decision-making process is dealt with in the section on Access Routines and in the section on the Valuing Procedures which were implemented through preference scripts. Additional scripting is to be found in the Occupational Script Network where scripts dealing with the "Politics of Decision-Making" and "How to Get a Job" are presented. (See Appendix II.)

## PRACTICE IN DECISION-MAKING THROUGH GAMES AND ITS COORDINATION WITH *Primary* DATA FILES

*Professional Personnel*

David Archibald and Allan Ellis, Directors

*Sub-Contractor*

Abt Associates

*Summary*

The overall plan for constructing the Decision-Making Curriculum consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Construct and field test decision-making booklet for junior high school |
| September 1966—August 1967 | 2. Survey career games |
| September—November 1967 | 3. Plan educational, career planning, and achievement motive games |
| December 1967—March 1969 | 4. Prepare scripts called for in 3 above |
| April—June 1969 | 5. Implement 4 above as Prototype II without having a Prototype I |
| July—August 1969 | 6. Do restricted field testing of Prototype II to develop further specifications |
| September 1969—June 1970 | 7. Final reporting |

Work in this area during the past year reached phase 6 in our revised plan, particularly the modification and implementation of the Life Career Game.

### THE LIFE CAREER GAME

By the end of the year, the Game was undergoing field testing and debugging by members of the project and a few selected others. By this time the Game consisted of three Rounds—1, 2, and 3. Round 1, complete with sixteen scripts is operational on-line; Rounds 2 and 3, although defined in considerable detail, are not yet playable.

Important new elements introduced in the Life Career Game are as follows:

*New Profiles.* Four profiles, two male and two female, are now available, instead of one male. A range of academic ability, outside interests, and socio-economic levels can now be elected by the players. Furthermore, after playing a complete game with one of the specified profiles, a player will then have the option of playing again with a profile of his own creation. Because of modifications to be described below, this option requires minimal alterations in the script programming.

*New Procedures.* An important change in the conceptualization of the game has been made via the scoring system. It was felt desirable to make the scoring strike a balance between an external value system (the old version) and an expression of the player's personal value system. A relatively simple change has been introduced that approximates such a balance.

One plays the game by allocating time in a typical week to eight different kinds of activity (schoolwork, athletics, work, hobbies, social time with friends, etc.). In the revision, the player must name those four of the eight activity areas which are most important to his profile personality. The only restriction on his choices is that certain characteristics clearly defined in each profile must not be violated. For each profile, two or three (generally two) characteristics are determined by the script-writer to be either necessarily within or outside of the four choices by the player. Then the player's selections are checked for consistency within these limits and he is urged to change choices that are inconsistent. If he decides not to change inconsistencies, his decision is accepted, but he incurs small score penalties in each case. He is also asked his reasons for remaining inconsistent, and his answers stored, presumably for off-line analysis.

Scoring is based on the four categories of high importance. When a person calls something—say athletics—important for his profile, he is then expected to schedule a high number of hours for this activity relative to what he would do if the activity were not in the important category. He is not told directly what that criterion number is, but in some activities it is possible to make inferences toward that end. If he fails to schedule the criterion hours, he is told of this fact when he receives his score and his point total is sharply reduced. Otherwise, the scoring system (in terms of the points credited for various mixes of hours scheduled) is very much like the earlier versions of the Life Career Game.

At each of the three rounds (all taking place in high school), there is a major type of non-scored activity to perform. In Round One, a curriculum is chosen (either college prep or non-college). In Round Two, college prep profiles survey the college scene using a script which combines two scripts previously located in Round One, and non-college profiles survey occupational opportunities using the OCCPREFERENCE script. In Round Three, the college prep profiles will use the Education Data Base and Preference Scripts to choose a college, and the non-college profiles will choose a postgraduate job using either the Occupations or the Military Data Bases (and scripts).

The Life Career Game is central to the ISVD theory of development of student "choice" or "decision-making" because it incorporates those items necessary in decision-making—knowledge of facts on which to base a decision, and an evaluation of the application of those facts on a decision. In order to increase the knowledge of facts needed to make a decision, users learn to seek information from the data files available in the System. They learn to interact with scripts, and they learn what kinds of information might be necessary to make a decision. After making a decision for his "profile" based on the information he has acquired, the inquirer discovers the importance of each datum in making his decision through the scoring of the Game. He sees how well each bit of knowledge fits into his decision-making scheme. The evaluation system for the Game is designed to reward the player for combining the largest set of data relevant to a given circumstance as he makes the decision. This is the process the ISVD is seeking to promote and facilitate. An awareness of this process on the user's part constitutes success for the System.

### ABT MACHINIST CAREER SIMULATION

While the Machinist Game is a promising candidate for on-line elaboration, time prevented its implementation. In a continued ISVD project, the Machinist Game, as one of a number of post-high school Career Games, would be a reasonable program to undertake. Implementation of some game like this one would be required if the ISVD system is to help build career planning skills for life beyond age 25.

### ACHIEVEMENT MOTIVATION DEVELOPMENT

The Second Annual Report described two procedures relevant to the ISVD: 1) a computer game which allows the inquirer to experience the effects of realistic goal setting, moderate risk taking, use of feedback and assumption of responsibility for the initiation of action; and 2) a personal change script allowing the inquirer to specify a goal, plan strategies for its attainment, periodically assess his own progress and re-examine or reformulate the goal in light of his experience.

It was decided that the concept of access routines embodied the aspects of the personal change script more adequately than a single program could. Therefore no work was done on this script.

The computer game was written and exists in a form which can be translated into MINORCA. Before priorities dictated a stoppage of work on operationalizing the game several slides had been created for it and still exist.

*Psychology*

## DECIDING AND VOCATIONAL DEVELOPMENT AND THEIR COORDINATION THROUGH *Secondary* DATA FILES

### *Professional Personnel*

Roger Brown, Thomas Hutchinson, Lawrence Lerer, Robert O'Hara, and David Tiedeman, Directors; Allan Ellis, Elaine Fisher, Wallace Fletcher, Dorothy Kunberger, and Terence O'Mahoney

### *Consultant*

George Pasquella, University of Iowa

### *Summary*

The First Annual Report and its two subsequent Quarterly Reports dealt with the areas of inquirer characteristics data file, general curriculum, and vocational development curriculum. These three areas are somewhat differently defined in the Second Annual Report as well as in this one and are also treated somewhat simultaneously.

The differences in treatment include:

A. Inquirer Characteristics are divided into two kinds, general and personal. General inquirer characteristics are of course personal but their use in the ISVD is intended for a more general audience than the inquirer himself. The two audiences which will be permitted access to these general characteristics are other inquirers, when the characteristics of all inquirers are treated anonymously, and counselors, when the characteristics of a specific inquirer are identified by his name. This latter use category will provide for traditionally permitted access to cumulated grades and other data on the educational progress of student inquirers. General inquirer characteristics are now reported in this sub-section. Personal inquirer characteristics will be reported in the sub-section immediately following.

B. The purpose of the so-called General Curriculum is more sharply focused. ISVD interest in the General Curriculum will henceforth be only twofold. On the one hand, ISVD will provide categorizations of terms in primary data files which permit access at a more functional level than the descriptions of the activities themselves. This level of cross-referencing is already somewhat inherent in the *primary* data files as presently organized. However, the *primary* organization was planned and implemented without explicit attention to the coordination of categories when the use demanded is conceived in terms of vocational and/or agency development. It is this coordination which represents the present second interest of ISVD in the general curriculum. This is why the general curriculum is sequenced in this Report between consideration of inquirer characteristics and the Self Attributes and Deciding instructional scripts.

C. The Vocational Development Curriculum is here limited to instruction in self attributes and their relation to educational and vocational opportunities. This instruction is being assembled in scripts here referred to as those on Self Attributes and Deciding.

The overall plan for coordination of deciding and vocational development through secondary data files is presently conceived according to the following general phases which are somewhat specific to the origins of the three parts of the now combined task as is noted in the headings of each of the last three columns:

(See page 13.)

Phases A.5., B.5., and C.5. are completed but only in the limited prototype form which was planned. Reporting is now underway.

## Inquirer Characteristics: General

### INQUIRER CHARACTERISTICS DATA FILE

Student data through June of 1968 for Bigelow Junior High School and Newton High School were recorded on Digitek forms. The information from these records was processed onto tape storage. The Bigelow Student Record, Newton Student Record, and College Entrance Examination Board Scores comprise the initial Inquirer Characteristics Data Base. Because of deadline priorities, a fourth form, Senior Survey of Future Plans and College Acceptance, was eliminated.

| | A. *Inquirer Characteristics: General* | B. *Cross-Referencing of Data Files: General* | C. *Self Attributes and Deciding* |
|---|---|---|---|
| June 1966—November 1967 | A.1. Plan cumulative record file and collect and code data for subjects likely to be used in field test of Prototype II | B.1. Survey for study-work links for use in cross referencing of education, occupation, and inquirer characteristics data files | C.1. Write behavioral specifications. Write scripts. Organize, winnow, and edit scripts |
| December 1967—June 1968 | A.2. Implement cumulative record. Provide Durstine-Wolff type of retrieval capacity. Provide for merging and subsequent accessing of inquirer characteristics secured from vocational development, decision-making, general education, and psychological curricula. | B.2. Provide and do cross-referencing of education occupation, and inquirer characteristics data files | C.2. Revise scripts, add needed scripts, and provide scripting of interchanges among scripts as well as data assembly for MONITOR |
| July—August 1[illegible] | 3. Implement Phases 2 and 3 above as Prototype I and engage in limited field trials to secure specification modifications of file for Prototype II | B.3. Implement 2 for Prototype I and engage in limited field testing of Prototype I to develop specification modifications for Prototype II | C.3. Implement 3 as Prototype I and engage in limited field testing of Prototype I to develop specifications for Prototype II |
| September 1968—March 1969 | A.4. Implement Prototype II file | B.4. Implement Prototype II | C.4. Implement Prototype II |
| April—June 1969 | A.5. Field test Prototype II | B.5. Field test Prototype II | C.5. Field test Prototype II |
| July 1969—June 1970 | A.6. Final reporting | B.6. Final reporting | C.6. Final reporting |

The Bigelow Student Record has I.Q. and STEP test data, I.Q. scores for the third, sixth, and eighth grades and STEP scores for the sixth and eighth grades. Local and national percentile ratings have been computed for both of these areas. Yearly seventh and eighth grade marks, quarterly ninth grade marks, general sixth grade ratings in the major subject areas, and seventh grade vocational plans are other items of information included on the junior high school form.

The Newton Student Record lists the courses taken each year, the grade and credits earned for each course, and total credit compilation for the year. The CEEB form lists the date and scores for each of the tests taken.

The information from the Bigelow Student Record, Newton Student Record, and College Entrance Examination Board Scores was processed from the tape form and implemented onto the disc. The templates and direct access material have been completed and are in operational form but were not ready during the actual field test.

## STUDENT CHARACTERISTICS AND SELF AS STUDENT

An attempt was made to develop a script dealing with the inquirer's characteristics as a student. To a limited extent this script brought the inquirer's recorded academic data into relation with his self estimates in the same areas in an attempt to sharpen awareness of self as student. However, since it is debatable whether grades alone are an adequate definition of "self-as-student" there was some ambivalence about the use of these data in this way. To some extent the student's criteria for "good student" were taken account of and a discussion of the practical basis for the importance of grade records in securing college admission or a job was included.

This script required considerable storage facilities and some complicated use of GLURP. In view of the pre-established priorities and the lateness of its preparation, the script was not available for use in the trials.

## Cross Referencing of Data Files

The problem of cross referencing from one data file to another was partially resolved by a system of direct access. If a student desires at any point in his interaction with the system to get information from some other data file, he can do so by directly accessing that data file and putting his question directly. If, for example, while reading the script on College costs, he wishes to know what tuition at Northeastern is, the Command Language permits him to go directly to the college data file and ask for tuition costs at Northeastern.

Cross referencing is also now somewhat embedded in the System both through use of level I records and Access Routines. However, cross referencing necessary for MONITOR is not well developed.

## Self Attributes and Deciding

### VISUAL ASPECTS OF THE ISVD

One of the key characteristics of the ISVD project was its goal of providing active rather than passive participation for the student in the process of acquiring guidance information. As distinct from a book or collection of pamphlets, the system demanded both mechanical and intellectual alertness, and in many ways the system could have for students some of the excitement of piloting an airplane. One element of this activity was the continuous challenge from many directions. The system would demand not only literacy and the ability to direct a line of inquiry but even a kind of visual knowledge that would let him interpret and deduce from materials quite different from printed sets of assumptions and conclusions. The critical fact is this: in a one hour session the amount of information that any student can get from purely verbal material is limited, and likewise the amount he can get from visual or aural material is limited, but when systems are used in combination, when the student is stimulated either successively or simultaneously by different types of material the result is an activity more the product than the sum of the components.

Among the possible components—other than print, which because of the nature of the information was inevitably the primary medium—the visual has a special part to play. Here the student is using the tools that outside school are some of the primary

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ones in his life. The generation that leaves its televisions often only to go to the movies, and that visits Niagara Falls chiefly to take photographs that will be in a few years more real than the experience of seeing itself—this generation can be reached in a special way by visual materials. And, perhaps more important, they bring with them years of experience and accumulated skill at visual interpretation; skill that cannot be matched by any other facet of their development. Few young people think with their minds. A short time ago we would have spoken of many who could "think with their hands". Today it would probably be closer to the truth to say that young people think with their eyes.

*Types of Visuals.* Choices among the many possible types of visuals were limited in two ways: first and more important were the mechanical limitations of the terminals, and these particular limitations will be discussed in a later section; second, there were limitations imposed by the order of business in the project. ISVD had no visual director until the entire network of scripts was finished. From the start then the basic problem was to graft visual material onto a pre-existing set of scripts, which in many cases were written by people no longer a part of the project and therefore not available for consultations or suggestions about possible changes in the material or procedure. The job then was to insert material without changing the balance as it existed.

The most important suggestion which can be made about future work in this area would be that the systems must be integrated from the start. Visual workers should participate in planning, consulting and developing the script material, and carrying through the realization of the system in close cooperation with the other components. An understanding of the roles and importance of different materials by all members of the working team is essential if an integrated, harmonious product is to emerge.

From the start then we have to speak of visual materials based on a set of verbal scripts. The primary role therefore was supportive. Concepts or states conveyed in verbal statements were illustrated and the resulting illustration appeared on the screen at the same time as the verbal exchange was in progress via the CRT and computer typewriter. This ruled out any extended visual material, whether a set of slides, a film loop, or a short film, because these would have destroyed the continuity and momentum of *the script*. Visual materials came then to mean slides, slides taken either of original scenes or reproductions of visual material such as charts or drawings.

Among the several parts of the ISVD system two can be quickly discussed from a visual point of view: the Occupational Data Base and the Educational Data Base. The largest percentage of the total number of slides was related to these two parts. Since eight hundred and fifty jobs were described in the Occupational Data Base even the provision of slides for a fourth of them amounted to a large job. Here the slides complemented successfully the verbal descriptions of the job categories. Critical facts as to salary, required training, availability and advantages were given verbally while slides that gave more the feel of the job appeared on the screen. This sense of job atmosphere couldn't have been conveyed easily verbally, but even a glance at the slide would somewhat reveal the feel of an architect's office or a typesetter's bench.

Slides in this category were obtained from three basic sources. First, a large number were shot personally on location in the Boston-Cambridge area. Others were obtained from Industry through a list provided by the U.S. Department of Labor. A few others were from Guidance Associates, New York. The limitation on the size of this part of the project was related to the short time available to assemble all the materials. Valuable as these occupational shots were, the number seen by any one student would be relatively small since he would be inquiring about, at most, perhaps a dozen jobs. The return here was smaller than for other parts of the project.

The Educational Data Base parallels the Occupational one and most of the statements made above hold true in this case also. The task here was once again to complement the verbal description of the colleges with slides that indicated the ambience. One problem in this connection was the fact that in this case the source of slides had to be the colleges themselves, and the Public Relations Staff at most colleges has a rather stereotyped image of what a college should look like. In other words the material they made available tended to conceal rather than to express the particular flavor of an individual school or location. Ivy-covered walls under blue skies, wholesome couples walking arm in arm toward the library—genre scenes of this type were all too prevalent. Only careful selection kept some of the informational value of these slides intact. One basic criterion used here for selection was the goal of bringing out the difference between high school and college experience. Dramatic differences were stressed where possible. Once again the problem of rate of return was an important one: any one student would be asking about only a handful of schools, and so investment of time in filling out this data base was less valuable for the student than time spent on scripts that would be used by everyone.

The examples given of the complementary use of slides should indicate their value in giving information—chiefly about atmosphere and the feel of a place or situation—information difficult to convey verbally. Another type of informational slide consisted of illustration in the form of charts and other material in summarized form. A series of 36 slides from the Department of Labor of charts dealing with occupational statistics used in the Occupational Handbook would fall into this category.

In addition to these types, there are slides that are more directly illustrational, and these in most cases accompany the third and central part of the ISVD system—the scripts. These slides fall into two basic types. First and most difficult were the cases where a visual equivalent was needed for an essentially verbal concept. An example of this was the problem of creating a slide to convey the idea of feed-back. Often the scripts suggested little dramatic situations that would present the idea. These scenes usually demanded "actors", settings and props. Unfortunately a couple slides of this sort could involve a day of shooting and the use of a number of people. But even more important than the technical difficulties was the fact that in these cases visual materials were a cumbersome method of conveying ideas that were naturals for verbal explanation.

Other, more basically visual illustrations were also used for the scripts. In these cases the need was often for material that embodied intangible concepts—moods or qualities—or were cases in which a set of visual supports were used for a sequence of slides that over a period of time conveyed an idea. The relationship between changes in salary and cost of living were suggested by a set of slides showing real scales and money to demonstrate how income could or could not balance the cost of living. Another example dealt with a combination of live shooting and drawn illustration, in which a student was to be shown thinking about careers. First the student was photographed, leaving extra blank space over her head. A photographic print was made on which her career "thoughts" were drawn. Finally this combination print-drawing was re-photographed as a slide to fit the ISVD format.

One final use of visuals was in games. The use of game situations was potentially one of the most valuable in the project. Nowhere are active participation and complex information combined so thoroughly. Here visual material would not be complementary or supportive or illustrative. Instead the ideas would be rooted in the materials of the presentation and the props would insure that the learning occurred through a participation in the game. One very interesting game involved a set of rockets with different design features and structures. The player, after becoming familiar with these rockets, had to identify the individual ones on the basis of scraps of information—fragments of shapes—that appeared on the screen. Inference, extrapolation, approximation—a number of skills and concepts of decision making were developed in the course of the game.

Future exploration in this area would be of tremendous value. The learning potential, both direct and indirect, in these situations is very high and the system as a whole is functioning at its most integrated.

*System Mechanics.* The mechanics of the finished system deserve special comment. One of the best aspects of the ISVD system is its flexibility. Many paths through the scripts exist and at any one of the many "intersections" the student can branch off to follow a section of another script for a certain distance. This flexibility creates a mechanical problem that has not yet been adequately solved in the visual area. All slide trays of a commercial variety depend on a fixed sequence. Slide number 66 is always shown after 65 and before 67. Further, any common tray holds no more than eighty to a hundred slides. Ideally the ISVD system should have all of its several thousand slides stored in open racks within the console, and any one slide should be accessible at any moment. No such readily available random access system existed when the ISVD hardware had to become fixed. No storage facility for this volume of slides existed either.

In its final state the ISVD system therefore handles the slides as follows. For each of the six terminals a set of twelve Kodak Carousel Trays was used. Only two of these circular trays could be mounted at a time onto the pair of Kodak Random Access Projectors, which then sent the images onto a series of angled, front-surfaced mirrors and from there to the viewing screen. Because of the opposing angles of the mirror system the slides had to be stored in the trays sideways, either to the left or to the right depending on the projector to which the tray was assigned. Anyone using the system had to choose a pair of trays from the storage closet, then mount the trays by a rather involved procedure of opening a door, pulling out a shelf, fitting the tray into a groove on the projector and sliding the shelf back in. Obviously, this limits the use of these materials by younger students, and in most cases requires the assistance of an attendant at the terminal. Also, the student is limited to the visuals for the scripts he planned in advance to use, and his decisions while the script is in progress will frequently take him into scripts for which the visuals are not contained in the two trays he originally chose, thus making necessary the involved procedure for changing the trays. All this might be avoided in any future work by the development of a fast random access Film Loop projector which could store in miniature the visuals for the entire system. This film loop could also be permanently installed within the console, avoiding the complication of changing trays. Could this be developed, the possibility of slides being lost or incorrectly replaced would also be eliminated.

*Summary.* A questionnaire circulated among the members of the Summer Institute held at ISVD in 1969 who had used the system showed unanimous interest in seeing more visuals used and in further exploration of the ways information could be presented visually. With this we repeat the recommendations: a close integration of scripts and visuals depends on a simultaneous development of the material as verbal-visual. Out of this will grow a variety of situations, in which sometimes the verbal material will be dominant, sometimes the visual. And also situations in which the visuals will not only be used to illustrate but also to structure; and in which the verbal material will not only be used to carry the concepts but also to clarify or comment upon a structure already developed visually.

*Technical Data.* The sources of all the slides in the ISVD system are listed in the CREDIT AND COPYRIGHT LIST which is on file with ISVD.

All MODEL'S RELEASES and COPYRIGHT CLEARANCES are also on file.

CAMERA

Honeywell Pentax H3V, 35mm, single lens reflex; clip-on meter

LENSES

55mm, f1.8, Honeywell Super-Takumar (Normal)
28mm, f3.5, Honeywell Super-Takumar (Wide-angle)
135mm, f3.5, Soligor (Telephoto)

FILM

Kodachrome II
Kodachrome IIA
High Speed Ektachrome
High Speed Ektachrome B

LIGHTING

Reflector photofloods, 375 watt, medium beam, 3400 Kelvin
FP-26B flashbulbs (focal-plane shutter type)
Mixed fluorescent (with filter: Tiffen Photar FL-D)
Daylight

CLOSE-UP ATTACHMENTS

Lentar Automatic Extension Tubes
Vivitar close-up lenses, #1, #2, #3

## THE SELF CONCEPTS PROFILING TECHNIQUE (SCPT) IN GENERAL

The Self Concepts Profiling Technique (SCPT) is a logical extension of the developmental, dynamic theory of self process proposed by O'Mahoney in his doctoral dissertation. It particularly attempts to bring to specifiability the multitude of tacit understandings and knowings of self which function as a basis *from* which an individual attends *to* his universe and with relation to which this behavior is so frequently organized.

An important aspect of the SCPT is that it provides a "picture" of various self concepts which is formulated in terms of the individual's own idiosyncratic constructs and semantic habits. This is done by assiduously avoiding the imposition of any foreign categorizing or analyzing schema. The individual himself is the principal agent of analysis and categorization. The SCPT has three principal phases. The first is a projective phase in which the Inquirer responds to pictures of people in ambiguous work-like contexts in an evaluative and descriptive mode. He then analyzes his own responses looking for and clarifying underlying themes and concepts. When he has finished this dimensionalizing phase he has constructed a list of the more important dimensions which he frequently uses in differentiating people one from another and from self. He has also made explicit two terminal categories for each dimension, has assigned them "positive" and "negative" values according to his feelings about them, and has ranked them in order of importance as he sees them.

In the second, the paired-comparisons phase, the Inquirer systematically applies each of his dimension-concepts to the pictures which are presented to him such that each picture is paired with every other. Thus a response matrix is constructed for each dimension such that its use by the individual, in 36 different situations, is recorded. The paired-comparisons procedure is much more sensitive to subtle and difficult to define differences than are rating or ranking procedures. It also provides two statistics which are particularly useful in relation to self concepts. The first, a coefficient of consistence, tells how consistently the individual applies a given concept. The second, a coefficient of agreement, gives an index of the amount of agreement between any two sets of responses. This latter is useful because when the Inquirer has finished applying all of his own concepts to the paired pictures he is asked to apply certain self-related concepts, such as "Ideal-Self", "Self at Work" or "Self as a Person in General." Each application, as with his dimension-concepts, provides a response matrix which can be compared with other matrices.

Phase three of the procedure, the profiling phase, consists of matching each of the self-relevant concepts against each dimension-concept in turn, obtaining a coefficient of agreement in each case. Thus, each self-relevant concept is describable in terms of its relationships with each of the dimensions on the Inquirer's dimension listing—a set of N coefficients of agreement being obtained for each self-related concept. Thus each self concept may be profiled on N dimensions. In addition the relationships between the various self concepts may be computed, along with several other indices.

During the third year, the SCPT was completed, programmed and implemented. However, machine procedures do not yet work properly. On its first two trials programs worked satisfactorily but, on attempting to implement the more complex statistical procedures for profiling, a deep-seated bug was discovered and later eliminated. Unfortunately, successful programming was therefore not achieved in time to use the SCPT during our field trial.

The on-line time required for the program to complete the recording of responses, determination of rank order and the computation of the coefficient of consistence, proved to be much less than expected. Thus, it looks as though the whole procedure will take less time than anticipated and can be usefully aided by the computer.

## THE SCPT AND VOCATION

Method for obtaining a numerical index of "vocation" was tentatively suggested and examined by O'Mahoney in his dissertation and is reported in Project Report Number 22. O'Mahoney's operational definition gives a highly specific meaning to the term "vocation." Generally it is defined as "the overall sense of the fitness or rightness which a person experiences when knowings of self are brought into relation with knowings of the world in the specific context of an occupation or occupations." Thus "vocation" can have sign and value; positive or negative, strong or weak. The coefficient of agreement reports the interrelationship between several self concepts each of which has its own sign and value. This value of the coefficient may be operationally defined as an index of vocation. By methodically permuting the self concepts and concepts of occupations which are used in the computation, those occupations resulting in the strongest, positive "vocation coefficient" may be identified and used as a point of departure for further interactions with the system (e.g., clarification) or with a counselor. O'Mahoney plans a paper on this specific aspect of the SCPT.

### FEMALE VERSION OF THE SCPT

A female version of the SCPT has been developed and is available as a machine version, too. Although the method used for selection of stimulus pictures was less rigorous than for the male version, initial trials with the female version indicate that it apparently has as good face validity as the male version.

### GROUP ADMINISTRATION AND SELF SCORING

Both versions have been tried as group administered instruments with the students of Tiedeman's Harvard course, "Man, Machine and Careers in Elementary Perspectives." The students recorded their own responses, computed coefficients of consistence and agreement and finally mapped their self concepts profiles. With this group of students, on this occasion, both versions worked successfully as group administrations.

### SHORT FORMS OF THE SCPT

Two attempts were made to construct short forms of the SCPT. These entailed:

a. Reducing the number of pictures used in the paired-comparisons phase, with the intent of trying to reduce the administration time, and

b. Reducing the picture description part of the projective phase from a free exercise to one in which only a limited number of adjectives or adjectival phrases, again with the intent of reducing the time required to administer this phase.

Neither attempt met with much success. Reducing the number of pictures used certainly reduced the time required for the paired-comparisons phase but at the cost of considerable reduction in the sensitivity of the procedure. There were also doubts about the completeness of the list of psychosemantic dimensions obtained this way. Increasing the constraints on the dimensionalizing procedure had the effect of making the content analysis much more difficult for the subject and also raised doubts about the adequacy of the list obtained.

Although there are undoubtedly ways in which administration time may be reduced, saving time appears bought at the expense of sensitivity and thoroughness.

Much work remains to be done in the development of this instrument, particularly with regard to studying its reliability and validity. Plans are already fairly well developed for such work to be conducted privately in the fall of 1969-70.

### FEELING TONE OR SELF REGARD

Another way of using the coefficients of agreement, for a given self concept in relation to the psychosemantically significant dimensions, is as indexes of the "feeling tone" of the self concept. This may be considered as more or less equivalent to "self regard." It is closely related to vocation, as defined above, since vocation is one way of looking at the overall or resultant feeling-tone of several self concepts in relation to occupations. As with vocation, feeling tone may be positive or negative and may range in value between +18.00 and -18.00. O'Mahoney is developing a paper on feeling tone of self concepts.

### ATTENDING HABITS INVENTORIES

The Second Annual Report noted our intention to develop Picture Interest Inventories, as extensions of the SCPT rationale, in relation to "the several domains of time investment considered in ISVD, namely, education, military service, vocation and family living." The intent was to create a procedure which would deal with the more global aspects of the individual's habits of relating himself to his environment, particularly in relation to the domains of time investment and self differentiation.

Attending habits—predispositions, sets or habits of attending to and valuing—are seen as inextricably linked with the processes of being interested. A procedure which, like the SCPT, uses pictures as stimuli, allows the individual to analyze and categorize his own responses (thus retaining the psychosemantic integrity of the data) and finally allows him to specify sets of dimensions or concepts to be used in the vernier-like paired-comparisons mode, would be a valuable resource for initiating exploration or clarification and other interaction modes for an inquirer in the ISVD.

Difficulties inherent in the idiosyncratic nature of the data and its gathering have caused delay in implementation of these procedures. Hence these developments will merely be reported, not made operable. Financial and time resources did not permit the latter.

In lieu of a developed and operational procedure, O'Mahoney will prepare a project report on Attending Habits and a rationale for or specification of an Attending Habits Inventory.

### VALUING PROCEDURE

A working version of Hutchinson's procedure has been developed. We only have demonstration data, however. The data requirements of centour analysis among flexibly determined subgroups are such that they are beyond the resources of this project.

Work on the procedure aimed at making it more efficient, i.e., reducing the computer time used per person and adding more of the features of the model to the working version. These include multiple cutting points per dimension of job satisfaction and an analysis of the subject's distance from the subgroup centroid on each predictor variable.

A number of additions to the model were considered. It is possible that a user may want to combine samples into larger groups prior to forming subgroups. One way of providing this option would be by employing some already existing grouping scheme (such as the Roe Classification System for occupations). The user might then be able to specify the level of the grouping scheme that best represents the kind of information he desires. Such a grouping scheme might have several levels of the classification system, for instance, ten or fewer groups at the highest level, between ten and fifty at the second, and so on.

In addition to the existence of levels of grouping there are some other requirements for the grouping system to be used. The system must reflect something significant about the members being grouped; that is, if a nonmember looks most like a group I then he should look more like some subcategory of I than like a subcategory of II, etc. There should be no miscellaneous category. There is little information in the statement, "you look like the miscellaneous group."

The score for subgroups, centour scores, operate in such a way that the nonmember compared to a subgroup may not look like the subgroup either because his scores are too high or too low. The centour score itself does not indicate which of these kinds of possible explanations is the correct one. The interpretation of the centour scores themselves cannot say anything about the direction of being unlike a subgroup.

This type of information should be made available to the user should he request it. The following data could be provided: the scores of the nonmember on each centour variable, the mean of each subgroup on each centour variable, and the difference between the subgroup mean and the nonmember's score on each centour variable.

Most of the computer time used by this procedure is during input, i.e., reading in the total sample. Since users might be charged according to how much computer time they actually used, it would be reasonable to provide some way of easily reducing the size of the total sample thus decreasing the amount of computer time required. If the members of the total sample were in random order on the input device, say a tape, then the first 10% would constitute a 10% random sample of the total sample. The user could select the size sample for which he was willing to pay. Periodically, the total sample would then have to be randomly reordered.

## DECIDING AND AGENCY DEVELOPMENT AND THEIR COORDINATION THROUGH SECONDARY DATA FILES

### *Professional Personnel*

Robert Aylmer, Director; Myra Gannaway, Charles Gunnoe, Terence O'Mahoney, David Tiedeman, and Esther Wiedman

### *Summary*

The overall plan for designing the system to facilitate emergence of agency behavior through repeated interaction in ISVD consists of the following general phases:

| | |
|---|---|
| June 1966—August 1967 | 1. Provide general theory on thought, choice, and action |
| September—November 1967 | 2. Specify sense of agency. Test scripts against concept. Plan for additional scripts and assessment and storage of assessments |
| December 1967—February 1968 | 3. Write additional scripts. Continue planning on psychology and ISVD |
| March-June 1968 | 4. Implement Phases 2 & 3 as Prototype I |
| July-August 1968 | 5. Do restricted field testing to develop specification modifications for Prototype II |
| September 1968—March 1969 | 6. Implement Prototype II |
| April—June 1969 | 7. Field test Prototype II |
| July 1969—June 1970 | 8. Final reporting |

The work in this sub-area actually reached implementation in late June 1969. Hence, no extensive field testing of the procedures could be undertaken but staff has tested out their rudimentary illustrations of MONITOR.

### ACCESS ROUTINES

Work on Access Routines in the third year of the project has been primarily concerned with the provision of decision-making monitoring. This has been accomplished through revisions to existing scripts, in order to store relevant information about interactions, and through creation of new scripts to elicit, process, and make permanent records of information not automatically registered in the system, but likely to be characteristic of inquirers at pertinent junctures in their use of the system. These monitoring procedures are described below, followed by a discussion of future directions for monitoring which have arisen from the field test experience.

Monitoring exists in different levels within the system. At a relatively basic level, the system keeps track of how often the inquirer has been with the system, and how often he has used specific components. Such information is utilized in orientation scripts, as mentioned above, where branching logic can be made contingent on the inquirer's interactive history as well as current statements.

An inquirer's first contact with the system involves introductory scripts, which collect basic information from him and instruct him in the use of the system, as in the following example:

#### Introduction to the System[1]

```
PLEASE TYPE YOUR ID NUMBER SO THAT YOU CAN BEGIN.  PRESS THE
BUTTON MARKED SEND BLOCK WHEN YOU FINISH.  (IT'S ON THE RIGHT
SIDE OF THE KEYBOARD.)

0001

YOUR ID NUMBER HAS BEEN RECEIVED.  NOW PLEASE TYPE YOUR
PASSWORD.  IT WILL BE INVISIBLE SO NO ONE ELSE CAN READ IT.
PRESS SEND BLOCK WHEN YOU ARE DONE.
```

---

[1] The procedures described below are all operational and are now included in the active system. However, many of them remained in preparation during the field test period, and therefore were used very infrequently or not at all by field test inquirers.

(Types in password)

BEFORE BEGINNING WITH THE REST OF THE SYSTEM, WE NEED TO KNOW CERTAIN BASIC FACTS ABOUT YOU. PLEASE TYPE YOUR FIRST AND LAST NAMES. PRESS SEND BLOCK WHEN YOU ARE FINISHED.

Robert Davis

THANKS ROBERT. NOW YOUR AGE IN YEARS. PLEASE USE NUMBERS, NOT WORDS.

16

ARE YOU A MALE OR FEMALE?

Male

NOW TYPE YOUR GRADE IN SCHOOL. PLEASE USE NUMBERS, NOT WORDS. SOPHOMORE = 10, JUNIOR = 11, SENIOR = 12.

11

WELCOME TO ISVD, ROBERT. WHEN YOU SEE THREE ASTERISKS *** AT THE BOTTOM OF THE SCREEN, THE MACHINE IS READY TO RECEIVE YOUR RESPONSE. IF YOU DON'T FEEL LIKE SAYING ANYTHING, SIMPLY PUSH THE "SEND BLOCK" BUTTON. TRY THAT NOW.

(Pushes Send Block button)

SOMETIMES WE WILL ASK A DIRECT QUESTION, BECAUSE WE NEED TO KNOW SOMETHING FROM YOU BEFORE GOING ON. WHEN WE DO, PLEASE TYPE IN WHAT YOU WANT TO SAY AND PRESS SEND BLOCK. IS THIS CLEAR SO FAR?

Yes

YOU ARE ALMOST READY TO USE THE SYSTEM. THERE ARE JUST A FEW OTHER THINGS YOU SHOULD KNOW ABOUT. IF YOU SHOULD WANT A PRINTED COPY OF WHAT IS ON THE SCREEN, WAIT UNTIL YOU SEE THE THREE ASTERISKS AND THEN PUSH THE BUTTON MARKED COPY PAGE. WAIT UNTIL THE MATERIAL HAS BEEN COPIED. THEN TYPE IN YOUR RESPONSE AND "SEND BLOCK." TRY IT NOW.

(Pushes Copy Page and Send Block buttons)

DID YOU GET A PRINT-OUT OF WHAT WAS ON THE SCREEN?

Yes

```
GOOD. SOMETIMES YOU WILL NOT KNOW HOW TO ANSWER THE
SYSTEM WHEN IT ASKS YOU A QUESTION. IN THIS CASE, YOU SHOULD
TRY TYPING @HELP. TRY IT ONCE.

HELP

NO, YOU DID NOT TYPE THAT CORRECTLY. TYPE THE SYMBOL @ AND
THEN HELP. DO NOT PUT A SPACE IN BETWEEN.

@HELP

FINE. SOMETIMES THE SYSTEM WILL GIVE YOU A HINT WHEN YOU
ASK FOR HELP, BUT NOT ALWAYS. YOU CAN ALWAYS TRY, THOUGH.

...

WHAT WOULD YOU LIKE TO DO?
```

On subsequent visits to the system, a check is made to determine whether a record of basic information exists for him, and he is given an increasingly brief review of the system operation and commands, with the opportunity for a more extensive review if he wishes.

At a slightly more complex level, many scripts, including preference and direct access scripts, have been modified to create summaries of each inquirer's interaction with the script, so that subsequent sessions with a given script include a review of the prior use of that script.

For example, in a script written to allow sorting of the occupational data file on the basis of an inquirer's preferences for different Dictionary of Occupational Titles (DOT) groupings, the inquirer first selects a broad occupational category (professional, technical and managerial, clerical and sales, etc.) corresponding to the first digit on the DOT code, and then a specific division within that category, corresponding to the second digit. On a subsequent interaction with this script, the system will recall this stored data from the inquirer's file and display the message:

```
LAST TIME YOU WERE INTERESTED IN PROFESSIONAL, TECHNICAL, AND
MANAGERIAL JOBS HAVING TO DO WITH LAW AND JURISPRUDENCE.
YOU CAME UP WITH THESE POSSIBLE JOBS: LAWYER, JUDGE
```

before going on to elicit his current preferences.

In other preference scripts, specific choices made within relevant factors are stored and retrieved upon further uses of the script. If a student has selected Geographic Location in two successive interactions with the college preference script, for example, the second request for his preferred area will include his prior choice:

GEOGRAPHIC LOCATION IS GENERALLY CONSIDERED TO BE AN IMPORTANT CONSIDERATION IN COLLEGE CHOICE. LOOK AT THE SLIDE (a map of the United States divided into regions) AND TYPE IN THE AREAS OF THE COUNTRY YOU'RE INTERESTED IN:

YOU BEGIN WITH 376 SCHOOLS

A. NEW ENGLAND
B. MIDDLE ATLANTIC
C. MIDWESTERN
D. SOUTHERN
E. WESTERN
F. SOUTHWESTERN

LAST TIME YOU SAID E

A record is also kept, in binary form, of the jobs or schools which were retrieved in the preference script.

Further information is stored on the factors that the inquirer has chosen to use in sorting through the data file. If from one interaction to another an inquirer either adds a new factor to consider, or deletes a previous one, this fact can be made known to him. If so, he is asked whether he wishes to make a statement about any changes in his orientation toward this decision. He is then asked to compare his reason with two sets of possible reasons, one written into the script and another derived from other inquirers. If he feels that none of these reasons is close to his, i.e., that his reason is a unique one, he is given the opportunity of adding it to the inquirer-generated set:

### Sample Monitoring of Factor Changes

ON THE FACTOR SEX OF STUDENT BODY (MEN, WOMEN, COED), YOU FELT IN THE PREFERENCE SCRIPT IT WAS IMPORTANT, BUT BEFORE IN YOUR LIST OF GENERAL CRITERIA YOU DID NOT MENTION IT. PLEASE EXPLAIN BRIEFLY WHY.

I got married.

SOME GENERAL REASONS FOR ADDING A FACTOR ARE:

1) I WANT A SMALLER LIST OF SCHOOLS.
2) SOMEONE SUGGESTED THAT IT MIGHT BE IMPORTANT.
3) I HAVE CHANGED MY MIND AND NOW THINK IT IS IMPORTANT.
4) I WANTED TO KNOW HOW THIS FACTOR WOULD CHANGE MY ALTERNATIVES.

(Makes a hard copy)

YOU SELECTED SEX OF STUDENT BODY (MEN, WOMEN, COED) IN THE PREFERENCE SCRIPT BUT NOT IN YOUR LIST OF GENERAL CRITERIA.

5) THE SCHOOL MEETS MY REQUIREMENT SO IT IS LESS IMPORTANT.

LOOK AT THIS AND YOUR GENERAL LIST. TYPE THE NUMBER OF THE REASON LIKE YOURS OR "NONE" IF YOURS IS DIFFERENT.
YOU SAID "I GOT MARRIED"

None

GREAT. MAY WE USE YOUR REASON TO SHOW OTHER INQUIRERS?

Yes

GOOD, NEW ANSWERS HELP US IMPROVE THE SYSTEM. WOULD YOU PLEASE TRY TO MAKE YOUR REASON SHORTER AND MORE GENERAL. IF YOU THINK IT IS OK NOW, JUST PRESS SEND BLOCK.

YOU SAID "I GOT MARRIED."

(Presses Send Block)

*Data Access Records.* The scripts which provide direct links with the ISVD data files have been modified to keep records for each inquirer of the possible choices (jobs, colleges, etc.) he has inquired about. When he has received a complete description of a choice, or when he has indicated an interest in a different choice from the one under consideration, he is asked whether or not he can classify this choice as a desirable or undesirable one for him. The choice is then placed on his "good" or "bad" list for that decision, and he is asked for a statement about why the choice looks good or bad to him. His statement is then subjected to a content analysis procedure (called ANALYZE) which maps it into a set of general factors analogous to those used in preference scripts.

ANALYZE is a general-purpose "service routine" complementing several ISVD components. It creates a binary vector representing those factors recognized in the inquirer's statement, which can then be decoded and verified with the inquirer and stored for later comparison with vectors derived from other statements. An example of an interaction with an exploration procedure eliciting and verifying a statement about an inquirer's important factors for the discontinuity of college choice, together with an ANALYZE mapping and direct input to the college preference script is given below:

### Example of College Exploration

WHAT DO YOU WANT TO DO?

Find a college.

WHAT'S IMPORTANT TO YOU IN THINKING ABOUT COLLEGES?

I want to know how much it will cost, how far from my city the school is and if I can get in with my board scores.

WE RECOGNIZED WORDS REFERRING TO URBAN OR RURAL SETTING, ADMISSION REQUIREMENTS, COSTS IN YOUR RESPONSE. IT'S ALMOST CERTAIN THAT THIS LIST DOESN'T INCLUDE ALL OF WHAT'S IMPORTANT TO YOU IN CHOOSING A COLLEGE. THE LIST MAY ALSO INCLUDE SOME MEANINGS THAT AREN'T IN YOUR STATEMENT AS YOU SEE IT.

Yes, it does.

IF YOU WANT TO KNOW HOW WE GOT ANY OF THESE MEANINGS OUT OF WHAT YOU SAID, TYPE IN THE MEANING YOU'D LIKE EXPLAINED, OR TYPE NO IF YOU DON'T WANT ANY MORE EXPLANATION. (URBAN OR RURAL SETTING, ADMISSION REQUIREMENTS, COSTS.)

Admission Requirements.

IT SEEMED YOU WERE TALKING ABOUT ADMISSION REQUIREMENTS WHEN YOU SAID "GET IN." DID YOU MEAN ADMISSION REQUIREMENTS?

Of course.

ARE THERE ANY OTHERS YOU WANT EXPLAINED? (URBAN OR RURAL SETTING, ADMISSION REQUIREMENTS, COSTS.)

Urban or rural setting.

IT SEEMED YOU WERE TALKING ABOUT URBAN OR RURAL SETTING WHEN YOU SAID "FAR FROM MY CITY." DID YOU MEAN URBAN OR RURAL SETTING?

No.

WHAT DID YOU MEAN WHEN YOU SAID "FAR FROM MY CITY"?

I mean I didn't want to go too far away from home.

MAYBE WHEN YOU SAID "FAR FROM MY CITY" YOU'RE TALKING ABOUT GEOGRAPHICAL LOCATION INSTEAD OF URBAN OR RURAL SETTING, SINCE YOU NOW SAY "FAR AWAY FROM HOME."

Correct.

GEOGRAPHIC LOCATION IS NOW ON YOUR LIST INSTEAD OF URBAN OR RURAL SETTING. ARE THERE ANY OTHERS YOU WANT EXPLAINED? (GEOGRAPHIC LOCATION, ADMISSION REQUIREMENTS, COSTS.)

No.

In verifying the content analysis with the inquirer, he has the option of asking about any of the factors recognized, and restating the meaning of any he disagrees with. Note that the routine remembers the elements of the original statement which triggered the dictionary match (in the latter case "far . . . city" for urban or rural setting) and asks him for a clarifying statement. This new statement is again put through ANALYZE, and if the new match satisfies the inquirer, the old factor is replaced by the new one. If the second pass through ANALYZE still fails to provide a match the inquirer is willing to agree on, he is given the option of retaining or deleting the second factor. The statement elements triggering dictionary matches are stored, providing a foundation for increased individualization of dictionary processing.

The following information is stored by this procedure:

a) The inquirer's original statement;
b) A binary vector representing the initial dictionary analysis;

c) A binary vector representing the final dictionary analysis;
d) The elements of original or clarifying statements which triggered dictionary matches;
e) A statement about additional factors not mentioned.

These data are indexed by session number and type of decision, e.g., college job, etc.

The following is an example of the type of dictionary used in the ANALYZE procedure:

College Choice Dictionary

0 = Any number of intervening words, or no words.
$ = Check only this far.
( * )= Any of these words will do.

| FACTOR: | EXPRESSIONS: |
|---|---|
| Geographic Location | North$, South$, East$, West$, Mid-west$, New England.<br>Where is<br>In what part 0 ( *U.S. US Country)<br>( *Near far close away) 0 ( *home family Folks Mother Father Parents Friends) |
| Type of College | Public, private, Religio$, Catholic, Jewish, Protestant<br>State ( *School$ Colleges Universit$) |
| Sex of Student Body | Coed$, Co-ed$, Boys, Girls, Men$, Women$ |
| Size of Student Body | How ( *Large Small Big Little Many) 0 ( *Student$ People Boys Girls Women Men It Is)<br>( *Whether If How) 0 ( *Large Small Big Little Many) |
| Types of Programs | ( *Course$ Program$ Subject$ Major$) 0 ( *Have Has Offer$ Avail$ Giv$)<br>What 0 ( *Stud$ Major$)<br>Liberal Art$, Pre-$ |

| | |
|---|---|
| Financial Aid | Scholarship$, Loan$<br>Financ$ (*Aid Help Assit$)<br>Can't afford<br>Help$ 0 Pay<br>(*Part-time Team-time) 0 (*Work$ Job$)<br>(*Work$ Job$) (During While at in) 0 (*School College University There) |
| Urban or Rural Setting | Rural, Urban<br>(*Near Far In) 0 (*Town Citi$ City Country) |
| Special Courses | Seminar$, Tutorial$<br>(*Special Extra Differ$ Honor$) 0 (*Cours$ Program$ Stud$ Class$) |
| Extracurricular Activities | Band, Orchestra, Music, Club$, Fratern$, Soror$, Fun, Good Time$ |
| Admission Requirements | Admit$, Admis$, Sat$, Boards, Scor$,<br>Get$ 0 in, Let$ 0 in<br>(*Grade$ Rank$ Stand$ Test$) 0 (Need$ Neces$ Requi$ Should Have Ought) |
| Cost | Cost$, Fee, Fees, Books, Expense$, Tuition |
| Housing | Dorm$, Room$, Liv$, Apartment$, Resid$, Housing |

The procedure which elicits and keeps records on whether an inquirer perceives a potential choice as good or bad for him can be combined with the exploration procedure presented in the *Example of College Exploration* via the ANALYZE routine to provide comparative monitoring of decision-making behavior over time. A set of higher-order monitoring procedures have been integrated with the system which assess what monitoring activities have taken place while keeping records on an inquirer's activities in the system.

For example, the procedure which creates a record of the possible alternatives an inquirer has classified as "good" (on his terms) also checks on how many "good" possibilities he has indicated. When an inquirer has accumulated three or six[2] possible choices in his record, different sub-procedures are called into play. At the three-item point he is asked if there is one alternative which seems to stand out for him as the one he feels he actually will choose. If no clear preference is apparent at this time, he is asked if he can make a general statement about why these alternatives are desirable ones for him. This "meta-statement" about his set of possible future choices is also stored in his file, for future comparison with additional "meta-statements" and with specific statements about individual choices.

If, however, he does indicate that choice has occurred, he engages a clarifying procedure which attempts to relate his currently preferred alternative with past statements about general attitudes toward the decision. Related statements, as mapped by the ANALYZE procedure, are retrieved from his personal file and compared with current statements about the specific alternative. An example of dialogue with this set of monitoring procedures is the following:

### Clarifying Monitor Procedures

YOU JUST GOT SOME DATA ABOUT BOSTON UNIVERSITY. DO YOU CONSIDER THAT COLLEGE?
    GOOD
    BAD
    NEITHER GOOD NOR BAD?

Good

WHY DO YOU CONSIDER BOSTON UNIVERSITY TO BE A GOOD COLLEGE FOR YOU?

It's close to home and I think I can get in and I hear there are good fraternities there.

YOU'VE SAID THESE 3 COLLEGES LOOK GOOD TO YOU:

1. TUFTS UNIVERSITY

---

[2] These numbers are essentially arbitrary, and determined primarily by considerations of storage capacity within the system. There are no apparent theoretical bases for specifying desirable limits or intervals for such a file.

2. BOSTON COLLEGE
3. BOSTON UNIVERSITY

DOES ANY OF THESE COLLEGES STAND OUT AS THE ONE YOU'LL GO TO?

Yes

WHICH ONE? (TYPE THE NUMBER)

1

YOU SAID TUFTS UNIVERSITY LOOKS GOOD BECAUSE "IT'S NOT FAR FROM HOME AND IT'S NOT TOO EXPENSIVE." IS THERE ANYTHING YOU'D LIKE TO ADD TO YOUR REASONS FOR LIKING TUFTS UNIVERSITY?

It has good fraternities.

WHEN YOU WERE TALKING ABOUT COLLEGE IN GENERAL,[3] YOU SAID GEOGRAPHIC LOCATION, ADMISSION REQUIREMENTS, COST WERE IMPORTANT. IN DESCRIBING WHY YOU LIKE TUFTS UNIVERSITY, YOU SEEM TO BE TALKING ABOUT GEOGRAPHIC LOCATION, COST, SOCIAL ACTIVITIES. WHAT ABOUT ADMISSION REQUIREMENTS, SOCIAL ACTIVITIES?

They're okay.

HAVE YOU LOOKED INTO THE ADMISSION REQUIREMENTS, SOCIAL ACTIVITIES OF TUFTS UNIVERSITY?

Yes.

HOW DOES THAT MAKE YOU FEEL ABOUT TUFTS UNIVERSITY? IS IT STILL THE COLLEGE FOR YOU?

Yes.

YOU SEEM FAIRLY CERTAIN THAT TUFTS UNIVERSITY IS THE COLLEGE FOR YOU. WHAT DO YOU PLAN ON DOING ABOUT GETTING TO TUFTS UNIVERSITY?

See my counselor, get an application form.

Had the individual not maintained commitment to his chosen alternative, he could select another of his three colleges to clarify, find out more information about any of them, or continue to explore the data file for additional potential choices.

In addition to REVIEW functions which have been integrated with other system components e.g., Preference scripts, there is a separate Review procedure which feeds back to the inquirer a summary of interactions. It is accessed in two ways. First, after an inquirer has had several interactions with the system, the Major Orientation script checks his personal file for recent significant events, such as alternatives selected by Preference scripts or requested in Data or Template scripts, other scripts taken, and the major topics of interactions. It then displays for him a capsule description of his activities in the most recent session.

---

[3] This example is keyed to the earlier *Example of College Exploration.* The "colleges in general" factors are taken from that interaction.

Second, at any time during the course of an interaction, an inquirer may request a similar description of his current activities using the @SUMMARY command. In this case, after he has received a system summary of the interaction, he is linked to a separate script which elicits his own perceptions of the session, and his comparison of it with his expectations. In this script, prior statements of anticipation and expectation for sessions are retrieved as well.

The general form for the system review of a current or prior session is as follows:

### Sample REVIEW Interaction

```
@SUMMARY

TODAY YOU'VE BEEN WORKING ON A DECISION ABOUT COLLEGES. YOU
LOOKED AT SCRIPTS ABOUT FACTORS IN COLLEGE ADMISSIONS, COL-
LEGE PREFERENCES, COLLEGE DESCRIPTIONS, DATA.
```

**(Pushes Send Block)**

```
IN THE COLLEGE PREFERENCE SCRIPT, THE CHOICES YOU MADE SUG-
GESTED 6 COLLEGES:

    UNIVERSITY OF MASSACHUSETTS
    BOSTON UNIVERSITY
    BOSTON COLLEGE
    UNIVERSITY OF ARIZONA
    UNIVERSITY OF MARYLAND
    UNIVERSITY OF CALIFORNIA AT BERKELEY
```

(Pushes send block)

YOU ASKED TO HAVE THESE COLLEGES DESCRIBED:

UNIVERSITY OF MASSACHUSETTS
UNIVERSITY OF MARYLAND
UNIVERSITY OF CALIFORNIA AT BERKELEY

YOU ASKED SPECIFIC QUESTIONS ABOUT:

BOSTON COLLEGE

**(Pushes send block)**

YOU'VE NOW BEEN WITH THE ISVD FOR A LITTLE WHILE. HOW WOULD YOU NOW DESCRIBE YOUR EXPERIENCE HERE?

**Pretty interesting.**

THE SUMMARY STATEMENT YOU JUST MADE ABOUT THE WAY YOU FEEL ABOUT YOUR TIME WITH ISVD IS BEING SAVED FOR YOU. WHAT DID YOU EXPECT YOUR TIME WITH ISVD TO BE LIKE?

**I didn't really know.**

THERE ARE TWO COMMANDS (LIKE @DATA, @STOP, ETC.) FOR USE IN THIS SCRIPT ONLY. THESE ARE:

*THEN
AND
*NOW

NOTE THAT THE SPECIAL SYMBOL BEFORE THESE NEW COMMANDS IS * NOT @
TYPE *THEN WHENEVER YOU WANT TO LOOK AT YOUR STATEMENT ABOUT WHAT YOU EXPECTED YOUR TIME WITH ISVD TO BE LIKE.
TYPE *NOW WHENEVER YOU WANT TO LOOK AT THE STATEMENT YOU JUST MADE ABOUT THE WAY YOU NOW FEEL ABOUT YOUR TIME WITH ISVD.

HOW DOES YOUR EXPERIENCE WITH ISVD COMPARE WITH WHAT YOU EXPECTED?

**Strange.**

SORRY, WE COULDN'T UNDERSTAND. PLEASE TRY AGAIN.

**Pretty different.**

THEN YOU FEEL THAT THERE HAVE BEEN SOME CHANGES IN YOUR FEELINGS DURING THIS EXPERIENCE.
WHAT ARE SOME OF THE DIFFERENCES BETWEEN WHAT YOU EXPECTED AND WHAT HAPPENED?

**I don't know.**

WHAT WERE THE REASONS FOR THE DIFFERENCES BETWEEN WHAT YOU EXPECTED AND WHAT HAPPENED?

**I don't know.**

ARE THESE DIFFERENCES BETWEEN WHAT YOU EXPECTED AND WHAT HAPPENED IMPORTANT TO YOU?

**Yes.**

WHY ARE THESE DIFFERENCES IMPORTANT TO YOU?

**Because I didn't know what to expect and now I do.**

WE'VE ASKED YOU MANY QUESTIONS IN THE LAST FEW MINUTES, AND MAYBE YOU'VE ASKED YOURSELF SOME, TOO. YOUR OWN QUESTIONS CAN BE MUCH MORE IMPORTANT THAN ANY WE COULD ASK.
IF YOU HAVE ASKED YOURSELF SOME QUESTIONS AS WE'VE GONE ALONG, OR IF SOME COME TO MIND NOW, YOU CAN SAVE THEM IN YOUR PRIVATE FILE BY TYPING THEM IN.
IF THIS ISN'T SOMETHING YOU'D LIKE TO DO NOW, PUSH SEND BLOCK AND WE'LL MOVE ON.

**(Pushes Send Block)**

NOW LET'S REVIEW WHAT WE'VE BEEN DOING. YOUR STATEMENT ABOUT WHAT YOU EXPECTED YOUR SESSION WITH ISVD TO BE LIKE WAS, "I DIDN'T REALLY KNOW." AFTER YOU HAD BEEN EXPERIENCING ISVD FOR A WHILE, YOU MADE THIS STATEMENT ABOUT WHAT IT WAS LIKE: "PRETTY INTERESTING." THE COMMANDS *THEN AND *NOW ARE STILL AVAILABLE IN CASE YOU WANT TO LOOK AT THESE STATEMENTS AGAIN. YOU COULD ALSO MAKE A HARD COPY OF THEM TO KEEP.

*THEN

YOU SAID, "I DIDN'T REALLY KNOW."
AFTER YOU MADE YOUR SECOND STATEMENT, WE ASKED SEVERAL QUESTIONS. FIRST, WE ASKED IF THERE WERE DIFFERENCES BETWEEN WHAT YOU EXPECTED ABOUT ISVD AND WHAT YOU FOUND IT TO BE LIKE. YOU SAID, "I DON'T KNOW."
THEN WE ASKED WHY THERE DIDN'T SEEM TO BE DIFFERENCES, AND YOU SEEMED UNSURE.

**(Pushes Send Block)**

IN GOING THROUGH THIS REVIEW EXERCISE, YOU CHOOSE TO LOOK AT YOUR STATEMENT ABOUT WHAT YOU EXPECTED ONCE. YOU CHOSE NOT TO LOOK AT YOUR STATEMENT ABOUT HOW YOU FELT AFTER USING ISVD FOR A WHILE. FINALLY, WE ASKED IF YOU HAD ANY

QUESTIONS ABOUT YOUR EXPERIENCES THAT YOU WANTED TO SAVE, AND YOU CHOSE NOT TO SAVE ANY OF YOUR QUESTIONS.

The monitoring procedures described above, although they bear the names "EXPLORE," "CLARIFY," and "REVIEW," are not easily attributable to a discrete paradigm stage or system function. The EXPLORE routine, by its focus on dialogue about linguistic expressions of decision-making criteria, has a clarifying aspect, in that it makes more explicit, or at least points up tacitness of, bases for decisions. In addition, it performs these functions by engaging the inquirer in an immediate review of statements he had made about his decision-making.

The CLARIFICATION procedure also has aspects of EXPLORATION and REVIEW to it, particularly the latter. Statements about specific alternatives are elicited while the inquirer is in the process of sorting through data files without necessarily feeling commitment to one possibility over another, i.e., while he is exploring. The procedure takes its name from the fact that these earlier stages statements are REVIEWed when the inquirer has indicated at least tentative commitment to an alternative, i.e., when choice has occurred, and clarification of the alternative can logically be expected to begin.

The three access routines, EXPLORATION, CLARIFICATION, and REVIEW, which were originally conceived to overlay the system as separate but unifying linking and monitoring *routines*, are presently reflected in a number of different system routines which have been developed and modified to perform access *functions*. What we originally called Access Routines are now not discrete procedures, but a diverse and interpenetrating set of minute functions which physically reside in a number of locations. It is this systematic diversity which has enabled us to specify operationally what functions should be performed in an interactive Guidance system, and which provides the direction for future development of monitoring procedures.

An early ISVD document described monitoring in the system as a heuristic feedback device which would lead inquirers to develop in themselves a condition of doing-while-observing:

> "Aside from the usual reasons for monitoring a student's behavior—to analyze his performance, select from alternative courses of action, and generally maintain an account of his interaction with a system—the project expects to present to him the facts of this monitoring so that he might use them as additional data. These facts become a kind of meta-data which the student processes. Not only does the individual act but he becomes aware of his pattern of action. The desired result is a higher order of understanding of both the decision-making act and the panorama of career choice in which decision points are linked. Career becomes a time-extended set of choices, and decision at any given point is enhanced by an overall awareness of the road being travelled."
>
> (Ellis and Wetherell, 1966, p. 2)

It should be apparent that much remains to be done in reaching the level of feedback suggested in the above passage. Having created discrete system components to perform separate functions, modified them as monitorable behaviors became apparent, and created new procedures where monitoring was lacking, we are now in a position to continue system development with these steps more synchronized.

## *Computer Control for Processing of Secondary Data*

### *Professional Personnel*

Allan Ellis, Director; Thomas Hutchinson, Assistant Director; Roy Norris, Director of Systems Design; David Archibald, Toby Boyd, David Brewster, Susan Kaiser, Marjorie Madoff, Charles Roehrig, Richard Roman, Susan Roman, Arlene Scherer, Dorothy Swithenbank, Thomas Swithenbank, Heather Scott, Herbert Simons, Ann Taylor, Jeffrey Tiedeman, and Michael Tiedeman

### *Consultant*

Graham Smith

### *Summary*

ISVD is organized so that design of the computer and guidance systems proceeds apace, but interactively, to the extent that interaction can be arranged and maintained. In this regard the computer area originally offered the guidance area the computer capability planned as MINORCA. The guidance personnel accepted this design and worked within it during the Fifth and Sixth Quarters. During this time it became apparent that the capability originally planned for MINORCA needed augmentation by some of the capability inherent in ELIZA.

The procedural modification required by the incorporation of some ELIZA-like function in MINORCA has already been described in an earlier sub-section entitled "Computer Control for Presentation of *Primary* Data." Also, the experiments leading to orientation scripts in ELIZA are reported in that sub-section above.

The primary focus of these existing scripts is toward both orientation and Access Routines, where the need for natural language processing seems paramount. The success of this exploration caused our replacement of the MINORCA action statement by a modified ELIZA.

The theory of ISVD requires an English-like response. Recently a visitor to ISVD attempted the ELIZA orientation scripts. Upon reflection he said, "The System is not really responding to me." This statement represents both the dialectic within which *we* work to improve the System and the theoretical imperative which ISVD helps *a person* to realize and accept psychologically. The dialectic will be responded to during field test and specifying revision of Prototype II in our efforts to make the System ever more capable of personal-like responses. However, as noted in the second part of Section II, the fact of the matter is that personal-like statements will *never* fully be possible in any mechanical system. Therefore ISVD uses this foregone conclusion to interact with inquirers in a system, *seemingly* antithetical to it, 1) to teach them how to do things which can be done mechanically, 2) to let them do things in their career development with mechanical and personal help, and 3) to encourage them to rejoice in ultimate realization of the truth that life is theirs, not that of any machines.

ELIZA-like computer capability contributes to this theory in important ways. In the first place ELIZA-like computer capability permits programming in which a person may pass to parts of the System beyond those where he now works simply by mentioning right words *which do not have to be told to him beforehand.* In this regard, ELIZA gives the illusion that it is completely responsive to the inquirer's thoughts and needs. However, as the inquirer experiences the realization that ELIZA does not completely respond to him, he will then be helped by being taught what ELIZA actually *is* responding to. He will also in some regards be empowered to write and use personal programs in ELIZA-like forms. This activity will aid the inquirer to internalize the illusion of free response in a mechanistic environment. The experience, the practice, and aid at generalization by counselor and job supervisor will then help to complete the process by bringing a person to live the differentiated mechanical circumstance of the illusion without attributing power to it which is not the power of his own thought and action.

### *Counseling and Supervision in the ISVD and Required Re-Organization and Re-Education*

#### *Professional Personnel*

Sara Booth, Duncan Circle, Russell Davis, Richard Durstine, Wallace Fletcher, Edward Landy, Sheila Leahy, Lawrence Lerer, Priscilla Little, Robert O'Hara, David Tiedeman, and Michael Wilson

#### *Summary*

The overall plan for both providing counseling and supervision in the ISVD and for facilitating the required re-organization and re-education was reported in separate sections in the First Annual Report and its two subsequent Quarterly Reports. Those two subsections were combined in the Second Annual Report in order to demonstrate more of the coordination and direction which is involved in attempting to create a critical mass by the expiration of the present ISVD grant which will be sufficient in size to pick up and sustain the momentum which we have created with help of resource from the U.S. Office of Education. The following general phases were during 1967-1968 conceived as inherent in these coordinate activities and have continued to guide activity during 1968-69, the period of this Third Report:

| | A. *Re-organization of Counseling and Supervision* | B. *Re-education and Revision of Support* |
|---|---|---|
| June 1966—June 1969 | A.1. Establish relationships with NEEDS, Newton, WEMBROC, and other institutions required for resources, data, and field testing of Prototype II | B.1. Issue reports as they become available. Engage in professional activity designed to bring resources into the ISVD and to ready counselors and vocational educators for the ISVD |
| March 1967—June 1969 | A.2. Establish and help to maintain the extra support activities required in NEEDS, Newton, and WEMBROC for a try out of Prototype I and field testing of Prototype II | B.2. Incorporate graduate students into ISVD to prepare them for subsequent use of ISVD |
| January 1966—February 1968 | A.3. Plan for MONITOR and supervision. Mount rudimentary MONITOR for Prototype I | |
| March—June 1968 | A.4. Implement 3 for Prototype I | |
| July—August 1968 | A.5. Do restricted field testing of Prototype I to develop specification modifications for Prototype II. Expand MONITOR as much as possible | |
| September 1968—March 1969 | A.6. Implement 5 above as Prototype III. Prepare directions for supervision during field test and train needed support personnel | |
| April—June 1969 | A.7. Field test Prototype II | B.3. Conduct institutes for persons who are likely to become users of ISVD |
| July 1969—June 1970 | A.8. Final reporting | B.4. Final reporting |

## Re-Organization of Counseling and Supervision

Phase A.1. continued as planned. Phase A.2. took the form of a Career Resources Center maintained in collaboration with the Newton School Department. Phases A.3.-A.7. were completed as planned and A.8. will occur on schedule. The education part of the B sub-area also occurred on schedule.

### CAREER RESOURCES CENTER

A Career Resources Center was incorporated into Newton High School during 1967-68 and was in operation there on a somewhat limited scale for two months during that year. It has operated there throughout 1968-69. As was indicated in more detail in an earlier sub-section, the response by the students has been very positive and it strongly indicates that students want and will use information when it is available for education and vocational decision-making. The Center includes the library and the Jobs for Youth information. The initial activities included spending a week each in four different student lounges with an extensive display of free occupational literature and some audio-visual aids. More than 200 students had contact with the display in each of the locations. Many teachers also came and some brought their classes. Students followed up this initial contact by visiting the main Center where more information was available.

Resource speakers in different career fields have been asked to speak to groups of interested students. Several programs of that nature have been held.

Typical student requests for information were recorded and distributed to ISVD script writers for incorporation in the system during 1968-69. The Career Center served as a test site for Prototype II. College classes of Occupational Information from different universities visited the center from time to time. Counselors from vocational schools have visited the Center in order to learn about its development and organization.

## Re-education and Revision of Support

### RE-EDUCATION: PUBLICATION AND REPORT CIRCULATION

From time to time, the ISVD issues Technical Memoranda, Project Reports, and Working Papers. Technical memoranda are of the most enduring interest and are therefore printed. Project Reports are on matters timely to the theoretical and substantive development of the project. They are therefore multilithed. Working Papers are largely conceived for use of project personnel but are shared with a select list of persons who are also working in areas similar to that of the project. This latter group also receives substantive staff memoranda as these are prepared.

Since the inception of the project, 3 Technical Memoranda and 20 Project Reports have been issued. Five of the Project Reports were issued during the current year. Numerous others are being readied for reproduction as a part of the final reporting process. A complete list of issued titles in each of these series may be found in Section V.

Since inception of ISVD, we have maintained and circulated a mailing list with all ISVD publications. To date, this list numbers 312 individuals. Represented in this figure are persons in academic institutions and governmental agencies from 34 states and 11 foreign countries.

### RE-EDUCATION: PLANS FOR FINAL REPORTS

Reports at three levels are under consideration. There will be, of course, full documentation of the system, both the computer system and the guidance system. This documentation will be intended for the Office of Education and will be prepared and filed in ERIC as ordered by the Office. The Center for Vocational and Technical Education at Ohio State University has agreed to receive this documentation and to honor requests for it.

A more general level will deal with the theory and specifics of the several sub-systems incorporated into the ISVD. For instance, datafiles are one such sub-system, games another, etc. These reports will be considered in two ways. They will be written in direct relation to the ISVD itself and distributed as project reports or technical memoranda. However, they will also be conceived as potentially useful in other substances intended for educational purposes. Reports on sub-systems so conceived might well be publishable in the general literature.

The most general level of report of the system will be the overall level. Some of the material in the three Annual Reports of the

ISVD are presently written at this level. So is *Thought, Choice, and Action: Processes of Exploration and Commitment in Career Development* which Dudley and Tiedeman issued in 1967 and is now in press. However, another document now under consideration would be written privately with the most general conception of a machine in mind, namely that of Turing's imaginary and yet completely specified machine which merely reads, processes, and prints one character at a time. Within this broad view 1) the theory of the ISVD and of its diverse activities which have included the reprogramming of the computer software to make the ISVD theory possible, 2) the writing of ISVD examples of the operation of that software, 3) the undertaking of preliminary investigation of this software and the exploration of the use of the theory in vocational education when the computer itself is not used but the theory is to be presented both in detail sufficient to instruct and in generality sufficient to intrigue others to adopt some of the strategies and concepts even in the absence of an operating computer system.

We ourselves refer to these levels in their reverse order as the "why", the "how" and the "what" of the ISVD. It is our hope that a commercial publisher can be interested in publishing the general "why" book and some of the generalized "how" possibilities inherent in the ISVD sub-systems. Other "what" material will be issued as project reports since it will not have large enough market possibilities to merit commercial publication.

## RE-EDUCATION: VISITORS

During the past year, many persons visited with the ISVD staff and participated in discussions and/or demonstrations of the ISVD system.

Among these visitors were:

Dr. Robert Anderson, Professor of Education, Harvard University
Mr. Wilton Anderson, student, Harvard Graduate School of Education
Mr. Melvin Barlow, University of California at Los Angeles
Miss Marjorie Bell, Bell Associates, Washington, D.C.
Dr. Michael Bertoch, State University of Utah

Mr. Herbert Bright, President and Chairman, Computer Planning, Inc., Bethesda, Maryland
Mr. Vernon Dolphin, Greatest of All Design, Cambridge, Massachusetts
Dr. Frank L. Field, Counseling Psychologist, Counseling Center, University of California at Santa Barbara
Mr. Danny Fingerman, graduate student, Sloane School, Massachusetts Institute of Technology
Mr. Lawrence Fox, American Association of Junior Colleges, Washington, D.C.
Mr. John Hagberg, Belchertown Public Schools, Belchertown, Massachusetts
Dr. David Hershenson, Illinois Institute of Technology
Mr. Hubert Hogben, Scientific Advisor to the British Naval Staff, Washington, D.C.
Dr. Ronald Jackson, Research Associate, Massachusetts Advisory Council on Education
Mr. Leon Mann, Department of Social Relations, Harvard University
Mr. Joseph Martorana, Manpower Coordinator, Commonwealth of Massachusetts
Professor Patrick Meredith, Epistemic Communication Research Unit, Leeds University, England
Mrs. Marcia Meyer, International Business Machines Corporation
Mr. Leo Renaud, Member, Massachusetts Advisory Council on Education
Mr. Malcolm Rosier, Senior Research Officer of the Australian Council for Education Research, Hawthorn, Victoria, Australia
Dr. Alice Y. Scates, Program Planning and Evaluation, United States Office of Education, Washington, D.C.
Mr. Karl Schaeffer, Epistemic Communication Research Unit, Leeds University, England
Mr. Henry Shapiro, Technical Planning, Litton Systems, Inc., White Plains, New York
Dr. Richard S. Sharf, University of Wisconsin Counseling Center
Mrs. Maxine Stewart, Editor, *Occupational Outlook Quarterly*

Dr. Magnus Stiernborg, Department of Psychology, University of Stockholm, Sweden
Dr. Merrill Stocky, Director of Guidance, Milwaukee Technical Institute
Miss Judith Weinstein, Project Officer, United States Office of Education
Mr. Richard Wilson, American Association of Junior Colleges, Washington, D.C.

Board Members of the Technical Education Research Center
State Directors of Vocational Education in Maine, New Hampshire, and Vermont

## RE-EDUCATION: DISCUSSIONS AND SPEECHES

Project personnel engaged in dissemination activity called for in Phase B. 1 as follows:

David Archibald: On April 11, Archibald addressed a meeting of the National Association of Secondary School Principals in Washington, D.C. on the use of computers in education.

Richard Durstine: On December 5, Durstine spoke in Washington, D.C. to a meeting of the Advisory Committee on USES Tests. His topic was "The Use of the GATB and Other Measures in Computerized Counseling."

Allan Ellis: Ellis and Tiedeman presented the paper, "Can a Machine Counsel?" at the CEEB-SSRC Conference on Computer-Based Instruction, Learning, Testing and Guidance held at the University of Texas at Austin on 21 and 22 October.

At the American Personnel and Guidance Association convention held March 31 to April 3 in Las Vegas, Nevada, Ellis chaired a session entitled "Potent Predictors—The Use of Multiple Data to Improve Counseling." He also participated in the symposium, "Computers, Natural Language, and Guidance."

Wallace Fletcher: During the ninth quarter, Fletcher addressed the staff of Arthur D. Little Company in Cambridge, Massachusetts. In addition, he held meetings with staff members of the Massachusetts Advisory Council on Education to discuss methods of implementing ISVD-type programs within Massachusetts.

During the tenth quarter he met with the President and faculty of Washington Technical Institute. He also met with the California State Board of Education, Committee on Vocational Education, the California Junior College Board, and the California Advisory Committee on Vocational and Technical Education where he presented the report, "Vocational Education in California: Yesterday, Today, and Tomorrow." In November, Mr. Fletcher met with the California Vocational Education Staff Task Force and attended the Aerospace Education Foundation Conference.

During the twelfth quarter, he spoke to the Superintendent and faculty of Hughson Unified High School District, Hughson, California, concerning career development and the requirement for an integrated ISVD component.

He also spoke to Dr. James Plusch, Director of Vocational Education, Long Beach, California, about ISVD at the elementary and junior high levels; to Dr. Joseph Bellenger, Director of Vocational Education, San Diego, California, about ISVD as part of a career development and skill training program for the disadvantaged adult; and to Dr. Nathan Maccoby, Professor, Department of Communications Research, Stanford University, California, about the significance to adults of language level of material in facilitating comprehension as a function of motivation to learn.

Other speeches Fletcher gave were to the Assistant Director of the Career Information Center, San Mateo County School Board, Redwood City, California, on alternatives to complete computer control, i.e., the use of human resources in a differentiated information system; and to Dr. Roy Jastram, Professor, School of Business, University of California, Berkeley, on the options in answering the need for updating of career information—the role of federal, state, and local structures.

Lawrence Lerer: On August 26, Lerer spoke on "Regionalized Efforts and Computerized Guidance" at the Educational Innovation Center in Monterey, California.

Robert O'Hara: On 26 September, O'Hara spoke on "National Manpower Needs vs. Freedom of Occupational Choice" at a conference of the Association of College Admissions Counselors held at the Americana Hotel in New York City.

Both O'Hara and Tiedeman spoke at the NESDEC-HGSE Invitational Conference on Guidance and the Maturing Individual held on December 2 and 3. O'Hara read a paper entitled "ISVD: Information System for Vocational Decisions" and Tiedeman's topic was "The Establishment and Maturing Individuality: An Assessment and An Indictment."

O'Hara also attended the West Virginia Guidance Workshop held at Cedar Lakes, Ripley, West Virginia from December 8 through 13. While there he read a paper entitled "Psychological Aspects of Career Decision-Making."

O'Hara visited Southeastern Massachusetts Technological Institute on April 23 and gave an overview of the ISVD.

David Tiedeman: Tiedeman gave two papers, entitled: "Can a Machine Develop a Career? A Statement about the Processes of Exploration and Commitment in Career Development" and "The Information System for Vocational Decisions: Description, Subsequent Development, and Implications" on July 30 and 31 at the Symposium of Perspectives on Vocational Development in St. Louis, Missouri and sponsored jointly by Washington University and the Central Midwestern Regional Laboratory, Inc. On August 20, he presented "The Role of Decision-Making in Information Generation" in a paper-reading session at the XVIth International Congress of Applied Psychology in Amsterdam, The Netherlands.

He also spoke at the Convention of the Provincial Association of Protestant Teachers in Montreal on 21 and 22 November. His topic was "The Cultivation of Careers through Guidance and Vocational Education."

On January 25, Tiedeman also spoke on "The Cultivation of Careers through Guidance and Vocational Education" to the Developmental Career Guidance Advisory Group at Wayne State University, Detroit, Michigan.

At the annual convention of the American Personnel and Guidance Association he presented the paper "Can a Machine Admit an Applicant to Continuing Education?"

On April 7 in Bedford, New Hampshire, Tiedeman spoke to the 1969 Educational Leadership Conference on "The Cultivation of Careers through Guidance and Vocational Education."

On April 21, Tiedeman addressed the Vocational Guidance Workshop in Pennsville, Salem County, New Jersey. The subject concerned vocational guidance in the 1970's, grades 7 through 12.

He gave a seminar concerning ISVD and other topics at the University of Minnesota in Minneapolis on April 25.

On May 5, for the Richmond, Virginia Public Schools Guidance Services, Tiedeman held a press conference and luncheon, discussing "The Computer in Guidance in Education."

Tiedeman showed slides of ISVD and gave an ISVD system demonstration on a portable teletype to the Rhode Island Association of Guidance Counselors on May 12 at Brown University, Providence, Rhode Island.

At the Spring Joint Computer Conference in Boston on May 16, Tiedeman spoke on "The Presence of the Computer in the Classroom."

Eugene Wilson: On July 29, Wilson spoke at a Guidance Institute of the General Electric Corporation.

## RE-EDUCATION: STUDENTS

The ISVD deliberately involved students from the Harvard Graduate School of Education and elsewhere. Several students of the Graduate School of Education held appointments as research associates or research assistants in the project and completed their doctoral work in the program. One student of the University of Leeds also held appointment first as research assistant and later as research associate. Two students of Ellis Page at University of Connecticut worked under Allan Ellis in ISVD and NESDEC.

In addition, Davis, Durstine, Ellis, O'Hara, and Tiedeman are involved in the regular instruction at the Harvard Graduate School of Education. Each of these instructors makes use of the ISVD theory and resources in the interests of gaining its understanding and acceptance. O'Hara, and Tiedeman are particularly involved with students in guidance at Harvard. O'Hara conducted individual work on research in career development. Tiedeman conducted a course on Measurement and Educational Decision-Making which he reshaped in the curriculum of the Harvard Graduate School of Education as a course on Man, Machine, and Career in Elementary Perspectives. A large number of ISVD personnel lectured and assisted in that course.

### RE-EDUCATION: INSTITUTES AND DEMONSTRATION

ISVD and ISVD-related topics were the principal foci at the Northeast Invitational Conference on Measurement in Education, jointly sponsored by Harcourt, Brace, and World, Inc., the Harvard Graduate School of Education, and the New England School Development Council. About 100 persons in the northeast region who are guidance personnel in schools and colleges attended. Publication of the papers of the Conference is under discussion.

The Harcourt, Brace, and World, Harvard, and NESDEC Invitational Conference was also attended by directors or representatives from five Regional Educational Laboratories, along with persons representing, among others, IBM, Science Research Associates, the Technical Education Research Center (TERC), and the U.S. Office of Education. All laboratories were invited to send a representative but not all could or elected to do so. Participants in the Invitational Conference were divided on the second day of the Conference. Personnel from Regional Laboratories and the others noted above were given a two-hour morning demonstration of the ISVD. A discussion of the system took place in the afternoon. The problem of using and further developing the ISVD came under consideration during the third day.

Several Laboratories represented at the Conference are undertaking work related to the inquiry procedure which the ISVD attempts to facilitate. This relationship was discussed in the Conference and it became evident to both parties that common work should be shared more.

None of the Regional Laboratories are in position to use the ISVD in their next fiscal years. However, several Laboratories evidenced interest in having the ISVD move into a Phase II development. Representatives of these Laboratories indicated that they would be willing to work with ISVD in its Phase II so as to get the conception of regional data utilities diffused further than could be done with the time and resources of the Phase I ISVD grant.

The College Entrance Examination Board presently supports a Commission on Tests which is to advise it in early 1970 concerning revisions in its testing programs. This Commission of 22 distinguished persons and additional representatives of the Board and the Educational Testing Service met in Boston, Massachusetts during 19 and 20 June 1969. In conjunction with that meeting, the Commission visited the ISVD and engaged in two one-hour demonstrations. Tiedeman is suggesting that the Board might in the future consider organizing a data utility to serve the particular interests of its members and clients.

The United States Office of Education additionally supported a conference during the last week of June (An Invitational Conference on Computer-Assisted Guidance Systems) for certain representatives of the ES '70 schools and for a number of counselor educators around the United States. Donald Super, Teacher's College, Columbia University, and Frank Minor and Martin Bohn, Advanced Systems Development Division, IBM presented on one day of the conference the IBM ECES system. ISVD was demonstrated on-line for one day and Project PLAN was presented verbally by G. Brian Jones for half a day. Discussion of related topics, including papers given at the Harcourt, Brace, and World Invitational Conference, completed the program. Dr. Rhoda Baruch who sponsored the Conference with Tiedeman is writing the report of this Conference.

The United States Office of Education also provided additional support for the months of July, August, and September. With that support, a month-long in-service training program for guidance and computer personnel from three technical institutes was held in July.

For the four-week period, 7 July through 1 August 1969, the ISVD conducted an institute in the design, construction, and use of the ISVD computer-based guidance system. Participants included nine guidance counselors, teachers and computer persons from four technical colleges or institutes in Waco, Texas, Milwaukee, Wisconsin, and Springfield, Massachusetts. Dr. David K. Archibald, Education Officer for ISVD, directed the program in which several staff persons assisted.

The purpose of this Institute was to initiate the training of persons working in schools that might in the near future use an ISVD-like guidance environment. It is felt that guidance counselors with some understanding both of the theoretical system and the operating computer and guidance software would be in position to materially assist in the modification of existing and creation of new materials for a given school. A curriculum was prepared which presented all elements of the ISVD, including descriptions of the major hardware and systems software components, the data bases and the script network, while at the same time scheduling approximately 30 hours for the members to engage in on-line interactions with the ISVD. Intensive study was made of the design and construction of data bases and each participant prepared a small set of raw data into coded form and wrote supporting documentation. Preference script procedures were studied at some length as well, and each school prepared the text of a preference script that met their own criteria. In the final week, each person drafted an evaluative description of the ISVD and presented considerations they felt to be important in its revision for a future system.

It is important to mention two related assumptions that underlay the month's program. In the first place, all discussion was conducted as if there would be funding for a future program (an Information System for Career Decisions or ISCD) that would involve these people and their schools. This assumption made it imperative, consequently, that ISVD represent itself as nakedly as possible, with all flaws revealed. Insofar as the participants believed from the beginning that theirs was the responsibility for dealing constructively with an imperfect prototype, then whatever enthusiasm and commitment might come out of this involvement would not likely dull with a sense of having been sold something that tried to present itself as more than it was. That this objective was successful seems to be indicated in general group reaction to two situations during the last few days of the Institute. In a meeting with TERC officers, it was suggested that certain elements of ISVD could be quickly mounted to serve as an information retrieval system. Apparently (we are going by reports), this provoked a strong reaction along the lines that ISVD was a guidance environment and not a retrieval system, and that, for all its flaws, was what they wanted to be involved with. A few days later the group visited Interactive Learning Systems Inc., which demonstrated a fairly smooth, fast, and complete service which is more than retrieval in that its principal operation resembles the preference procedures of ISVD. By and large, the Institute men granted the serviceability of the ILS routines but showed no less commitment to the development of a working ISVD-like system for their own schools.

After a day of general evaluative discussion with Tiedeman, other staff persons from ISVD, and representatives from TERC, the Institute came to agreement on the following points:

1. Insofar as possible, that all four schools should be actively involved from the beginning of any new project;
2. That the population to be studied in such a project should be 11th-12th grade students in schools that typically send many students to the institutes (and these students continue to be valuable subjects after entering the institute);
3. That the data bases should include a national occupational file; a regional college file; and a local file that would relate job titles or areas to individual school curricula in a meaningful way;
4. That differing conditions among the schools might make the existence of some unique script-sets desirable and/or critical (this was felt to be especially important in Waco, where a severely undereducated rural population makes up an important element in the student body).

## REVISION OF SUPPORT: RELEASE OF TECHNICAL MATERIALS

The ISVD has prepared and distributed Project Reports and Technical Memoranda from time to time. However, the project additionally generates technical materials which can be used by parties with the appropriate support technology such as a computer.

The ISVD grant from the U.S. Office of Education requires that all materials and products be in the public domain. The intention of the ISVD was to create a critical mass within the life of its grant such that the energy of the created mass is sufficient to generate some forward momentum in the absence of a future grant. To this end, the executive committee of the project encouraged experimentation with ISVD materials whenever interest was expressed by other parties capable of making adequate use of the first generation of materials available under terms of the ISVD grant. The project is therefore now prepared to receive and honor requests from parties who are able to demonstrate that they have the technical equipment and supporting staff capable of using experimental materials but without effort to monopolize those materials and without great likelihood of claiming more for the materials than they can presently be said to produce.

Such requests in the future may be directed either to Professor Allan B. Ellis, Director, Center for Educational Software Development, NESDEC or ERIC at Ohio State University Center for Vocational and Technical Education.

## REVISION OF SUPPORT: CARRYING ISVD AFIELD

Activities in this area have taken place in the form of discussions with individuals in four main areas: 1) governmental officials other than those from the U.S. Office of Education; 2) educational administrators at state and local levels; 3) influential persons in the general public; and, 4) individuals involved in school system specifications.

A major effort was made on 12 October 1968 to focus attention on the financing of computer-assisted guidance systems. On 11 and 12 October, the ISVD was host to the Fifth Invitational Conference on Systems under Development for Vocational Guidance. The ISVD was described and demonstrated during the first day of this conference. The second day was devoted to a symposium entitled: "Forming a Generating Function for Research and Development of Systems in Career Guidance." Speakers were: Allan Corderman of the Radio Corporation of America, Allan Ellis of Harvard University, Norman Boyan of the United States Office of Education, and Jordan Baruch of Inter-University Communications Council (EDUCOM).

Mr. Eugene Wilson, formerly Research Associate, ISVD, is presently President, Interactive Learning Systems, Inc. The ILS Corporation offers computer-assisted choice facilitation among data on colleges, technical schools, and occupations. This Corporation has therefore been an offshoot of ISVD.

Lawrence Lerer, formerly Research Associate, ISVD is now Program Manager, Education Systems Division for the CONSAD Research Corporation in Pittsburgh, Pennsylvania. In this position, he is undertaking ISVD-like activities but without computer assistance. In this regard, he and Wallace Fletcher, Principal Investigator of ISVD, represent present users of ISVD conceptions in machine-free environments.

The ISVD was kept open to interested commercial firms throughout its existence. The concept and openness of the project led to specific interest from General Learning Corporation, the Interactive Learning Systems, Inc., as noted just above, the International Business Machines Corporation, Eastman Kodak Company, and Sanders' Associates. Several of these firms additionally contributed personnel, material, and/or free consultation, contributions which are individually acknowledged in Section IV.

During 1968-69, it became evident that the concept of the ISVD is presently larger than commercial firms consider economically feasible. No firm came forward and seriously discussed the possibility of either direct or adapted use of the ISVD. Nevertheless, it was decided that specific effort should be made during July 1969 to let all interested firms experiment with ISVD and consult with principals who had constructed its main operating parts. Accordingly an invitation for such experimentation and consultation was issued to 27 firms in June 1969. These were all the firms which we knew to have a possible interest. No firm was deliberately excluded. Several firms indicated their continuing interest in *our* further development of the concept of ISVD, but no firm troubled to send a representative to experiment and consult. It is true that we were late in issuing invitations. However, our failure to get attention is more likely due to the fact that the ISVD in its entirety as a Career Machine is beyond economic feasibility for one firm at the present time. This likelihood underscores necessity for the Phase II developments of the ISVD which are projected in our plans for continuation of the ISVD. A Phase II grant must among other things provide support for driving down costs of delivery of an ISVD-like environment.

## REVISION OF SUPPORT: PLANS FOR UNDERWRITING OF FURTHER DEVELOPMENT

Plans have been laid for the division of the ISVD into research and operating portions. Proposals were written in each area.

Support for further research was refused by the Committee on Basic Research in Education. Other sources of research support are therefore now being investigated.

Plans are being laid to seek support from the U.S. Office of Education for a second activity phase required for further *development* of ISVD-like environments. The plan essentially calls for generalization of the ISVD to Information Systems for Career Decisions (ISCD). The following four tasks are called for under the forming plan: 1) completion and more intensive formative evaluation of the ISVD during the first twelve months of a new grant; 2) simultaneous partial reprogramming of the ISVD: a) to secure a system which is more computer and console free than is the present ISVD, and b) to create an environment in which partial use of ISVD-like functions will in the future be possible and in which satellitic computer operation in a data utility could also be possible; 3) incorporation of several new school systems into an ISCD network while undertaking the subsequent system revision, extension, and experimentation needed to learn how to localize ISVD-like material most readily; and 4) after 18 months for 3 above, undertaking a formative 18-month evaluation of ISCD as a data utility. This grant in its entirety will be pursued through the Technical Education Research Center or TERC, Cambridge, Massachusetts. Part 1 of the plan may be initially pursued through the recently formed Center for Educational Software Development of the New England School Development Council.

An important breakthrough in extending the range of ISVD might take place via the interest of Professor Donald Oliver (Social Studies Education, Harvard Graduate School of Education) in the general capabilities of ISVD software. His expectation that the software might lead to interesting developments in his work with social studies curriculum encouraged him to make available space for the HGSE terminal in his office area. Accordingly, the HGSE terminal equipment was located in Longfellow Hall. As noted above, the equipment was also used extensively by students in Tiedeman's course, especially during May. They focused on the ISVD field test materials, rather than on the HGSE materials, however. Students and staff associated with Dr. Oliver had time only to play with the equipment in order to build an understanding of the capabilities of ISVD-type software. However, it is possible that programming in the social studies area still might be initiated this fall.

Discussion between Oliver and Tiedeman led to a tentative agreement to explore possibilities for an association of social studies and guidance projects in a local school system, if adequate funds can be found. In this association, the points of tangency between the two men's theoretical positions rank equally in importance with the general capabilities afforded by ISVD computer software.

The extent of systematic use of the Placement Office data and scripts is unknown at present. For the project to advance beyond a role of demonstration to one of utility, considerable clerical time will be required and the project has no resources for that. The equipment and the ISVD system were therefore merely made available to persons at HGSE upon request, an opportunity which was taken by no one.

## *Activities: Study and Assessment of the System*

### *Professional Personnel*

Terence O'Mahoney and David Tiedeman, Directors; Robert Aylmer, Richard Durstine, Allan Ellis, Wallace Fletcher, Myra Gannaway, Thomas Hutchinson, Edward Landy, Sheila Leahy, Robert O'Hara, Richard Roman, Myra Trachtenberg, and Patricia Yee

### *Summary*

The overall plan for study and assessment of the ISVD consists of the following general phases:

| | |
|---|---|
| June 1966—June 1968 | 1. Plan, construct and implement Prototype I |

| | |
|---|---|
| July—August 1968 | 2. Do restricted field testing of Prototype I to develop specification modifications for Prototype II |
| September 1968—March 1969 | 3. Implement Prototype II |
| April—June 1969 | 4. Do general field testing of Prototype II |
| July 1969—June 1970 | 5. Prepare final report. Write specifications for Prototype III. Deliver Prototype II and specifications for Prototype III |

Work in this area proceeded into its phases 3 and 4 during the twelfth quarter and is herein being reported except for later specific references in subsequent project reports. However, since appropriate console arrangements were not available on time, much of the planned preliminary hardware and software testing had to be abandoned and, at most field locations, user schedules had to be modified rather drastically. Thus the field test did not actually get under way until mid or late April.

Our particular use of the term "field test" has continued to cause confusion for others. As was pointed out in Quarterly Reports 11 and 12, we have never meant the phrase to indicate a "controlled, rigorous, empirical investigation." Our activities have certainly not been of that type and were not intended to be. What we have in fact been conducting is a *trial implementation*. Before a controlled empirical investigation can be conducted it is necessary to demonstrate that the system does in fact work as expected, thus the system is now implemented on just a trial basis. Our experiences during the twelfth quarter proved the wisdom of this view. So we continue to refer to our activities as trial implementation or formative evaluation.

The early weeks of our field activities were "bedeviled" by several kinds of difficulties. Hardware and software difficulties caused a relatively large number of failures and a lot of "down" time. Hardware problems included both the central hardware (the central processor and its support equipment) and the peripheral hardware (the CRT's, slide projector units, keyboards, and data phones). Electromechanical faults and failures were depressingly frequent and delays in servicing or obtaining the rather specialized spare caused further problems at individual user stations, such as WEMBROC.

### ACTIVITIES AT THE FIELD LOCATIONS

There were five field locations engaged in the trial implementation in addition to the ISVD home-based activities. These locations were:

1. Hamilton Elementary School (Newton)
2. Bigelow Junior High School (Newton)
3. Newton High School (Newton)
4. Western Metropolitan Boston Regional Opportunity Council (WEMBROC) situated in Waltham, Massachusetts
5. Harvard Graduate School of Education (HGSE) in Cambridge, Massachusetts

### ISVD

The equipment at ISVD has been used primarily for the purpose of debugging, editing and revising script materials and has been used regularly. For a period of approximately three weeks it was also used by students in the counseling program at the Harvard Graduate School of Education in addition to the equipment at the School of Education itself.

### HAMILTON ELEMENTARY SCHOOL

At Hamilton, a combination of initial technical problems and subsequent failures plus delays and somewhat low priority caused the start of trials at that location to be considerably delayed. Unfortunately, when the equipment was finally available for use, the field supervisor was taken ill and no stand-in was available. Thus, when equipment failure occurred at Bigelow, the Hamilton installation was cannibalized for parts to avoid the long delay in obtaining spares from affecting scheduled activities at Bigelow. Consequently, Hamilton was non-operational until the first week of June when a supervisor from another location was free to operate at Hamilton.

*Editing and De-Bugging Elementary School Materials.* Before becoming ill, Gannaway was able to engage in some preliminary, tentative contacts and discussions at Hamilton. She also thoroughly scrutinized much of the script materials which would be used there. Materials were found to be in very poor shape and sadly lacking in structure, quality and content. Consequently Gannaway launched into extensive debugging, editing and rewriting activities on-line, using the ISVD console. To this extent the delayed onset of implementation and the inoperability of the Hamilton equipment proved to be a valuable breathing space in which she could give her attention to material which, because of its low priority, would not otherwise have been debugged or edited.

Interaction with the materials during debugging soon revealed that some computerized scripts exhibited many of the disadvantages characteristic of the older type of authoritarian education, and reflected none of the recent advances in the fields of learning. Such scripts were inappropriate with regard to ISVD's stated goals; were inappropriate in regard to what is known about learning and mental health; some were inaccurate, included outdated concepts, and produced perceptual effects that clearly conflicted with their conscious intent.

Rather than continuing solely with debugging, some rewriting of the scripts—within their existing framework to minimize the computer time required for changes was immediately undertaken. Debugging and rewriting proceeded simultaneously with the expectation that both types of scripts would be field-tested and compared in the light of the students' responses. It was hypothesized that students who had experienced a preponderance of authoritarian interactions might need time for transition to a more independent and self-reliant stance.

To illustrate the kind of changes that were seen as desirable, a script segment follows:

YOU HAVE PROBABLY NOTICED THAT ALL AROUND YOU, YOU CAN SEE CHANGES.

WHEN THINGS CHANGE, THERE ARE DIFFERENCES. YOU CAN SEE THESE DIFFERENCES IN YOUR DAILY LIFE.
ALMOST EVERYTHING CHANGES IN SOME WAY OR ANOTHER.
WHICH OF THE FOLLOWING THINGS IN YOUR OWN LIFE HAVE YOU SEEN CHANGE? A TREE? THE WEATHER? A SCHOOL?

(Keyboard)

(If student typed "tree:")

YOU PROBABLY HAVE NOTICED MANY CHANGES IN ONE TREE OR ANOTHER. MANY TREES CHANGE COLOR AND LOSE THEIR LEAVES.
ON YOUR WAY HOME DURING THE FALL, YOU MAY HAVE ADMIRED THE BEAUTIFUL RED AND YELLOW LEAVES. A FEW WEEKS LATER YOU PROBABLY WERE SURPRISED TO SEE ALL THE BRANCHES BARE. THE TREE HAS CHANGED.

(If student typed "weather:")

THE WEATHER CERTAINLY DOES CHANGE! ONE DAY IT IS SUNNY, AND THE NEXT DAY MIGHT BRING A THUNDERSTORM. VERY OFTEN THE WEATHER WILL CHANGE DURING THE DAY. YOU CAN ALWAYS BE SURE OF CHANGING WEATHER.

(If student typed "school:")

THERE CERYAINLY CAN BE CHANGES IN THE SCHOOL YOU ATTEND. BUILDINGS CAN BE TORN DOWN, ADDITIONS TO BUILDINGS CAN BE BUILT.
ALSO, MANY TIMES WHEN YOU RETURN IN SEPTEMBER, YOU HAVE TO GET USED TO CHANGING FACES. PERHAPS THERE ARE NEW STUDENTS IN YOUR CLASS. MAYBE YOU EVEN HAVE A NEW TEACHER OR A NEW PRINCIPAL.

(To all students:)

NOW LET'S TALK ABOUT SOME OTHER CHANGES THAT MIGHT BE VERY CLOSE TO YOU. HAVE YOU EVER STARTED TO PUT ON SOME CLOTHES ONLY TO FIND THEY ARE WAY TOO SHORT OR TOO TIGHT?

The above script segment illustrates a traditional authoritarian structuring of the learning context. The underlying assumptions which it reveals would result in interactional effects and educational influences which would be negative for all concerned, both from an educational and also from a mental health point of view.

For example, although the above script presupposes a learner old enough to operate a computer console, to read the material, and to type in responses, the examples chosen to illustrate the concept of change are actually the ones regularly used at the nursery school and kindergarten level. Apparently there is also the presumption that individuals share identical perceptions.

Beginning with the opening communication the learner is placed in a passive receptive stance, and addressed in a patronizing manner. No opportunity is given the learner to become an active participant in a true learning experience. A hierarchical structure is assumed, constructed, and maintained, with its usual result of infantilizing the learner.

Restriction and constriction of the learner's options are apparent, narrow and low-level choices hindering learning. The learner apparently is assumed not to know what he is not told, and is reduced to the status of passive listener who can react only within a context appropriate for a much younger and more dependent person.

Such an illustration reveals the subtle and debilitating effects of an authoritarian structure, a structure which is directly antithetical to the healthy functioning of both educator and child, directly antithetical to a maximizing of learning possibilities, and in addition, a structure that is hostile to all participants. There are other models of interaction which are much more useful within the learning context.

In fact, even if one were a) restricted to the already executed computer procedures and steps illustrated above, b) restricted to the previously requested slides illustrating trees, weather, and school, and c) restricted to the existing overall authoritarian framework, it still would be possible to offer the learner a different kind of experience. Though far from an ideal situation, significant changes could be made.

For example, one could select content that is consonant with the expected age of a person who can interact with console and script. In this specific elementary school, most probably this would be a minimum of fourth-grade ability and a maximum of sixth. Fourth grade children today include those who discuss Vietnam, war, space travel, and the draft in quite a reasonable way. Indeed, even second-graders do so.

Restriction to the overall framework of the above script infers a telling stance, and multiple choice, rather than divergent questions to extend and expand the learner's knowledge. Even so, the telling could reach for a more democratic discussion among acquaintances, rather than clearly constructing a status hierarchy. Content selected for multiple choice could offer some range and depth, some opportunity for personal meaning and involvement, and for varied and more complex interpretations. Even the typing of the script might be altered in order to include and to encourage slower readers, and visually handicapped learners.

One possible alternative form the above segment might take is the following:

THE REAL WORLD IS A WORLD OF CONSTANT CHANGING.
SOME OF THESE CHANGES WE CAN EASILY NOTICE, OTHERS WE MIGHT NOT.
SOME CHANGES JUST SEEM TO HAPPEN WITHOUT REGARD FOR WHAT WE MAY DO—LIKE LEAVES TURNING AND RAIN FALLING.
SOME CHANGES PEOPLE CAUSE TO HAPPEN, FOR THEIR OWN PURPOSES AND REASONS.

CHANGES CAN SHOW VERY CLEARLY, OR CHANGES—SUCH AS CHANGES IN OUR THOUGHTS, FOR EXAMPLE—MAY NOT SHOW CLEARLY AT ALL.
HAVE YOUR EXPERIENCES MADE SUCH IDEAS SEEM ACCURATE TO YOU TOO, OR DO YOU FEEL DIFFERENTLY ABOUT ALL THIS?

(Keyboard)

HAVE YOU NOTICED ANY OF THE FOLLOWING CHANGES RECENTLY?
A CHANGE IN SOMEONE'S:
    IDEAS?
    LIKES?
    HOUSE?
(PLEASE TYPE ONLY ONE ANSWER.)

A script modification of this type, utilizing the original slides picturing trees (line 4 in this segment), weather (line 4), and a house (line immediately above), allows a learner to experience some individuation, range and movement in his interpretations, and also increases his opportunities for making meaning with the data from his own life experiences. It communicates the expectation of individual differences, and of individual causality with regard to personal ideas and beliefs. It assumes that he is capable of thinking for himself. It demonstrates an alternate way of operating and communicating with an identical learning framework.

Other script characteristics which were perceived as in need of modification include:

1. any script which pressured for conformity and dependence on authority, for ISVD's explicit goals include developing the learner's sense of agency, and encouraging maturity;
2. scripts which had the student talk about, read about, and hear about specific behavior rather than structuring the script so that he could do it for himself, and thus learn it;
3. instruction that was conscience-driven, routinely using guilt and shame as motivators, and positing catastrophic consequences if the student failed unthinkingly to obey; a threatening and hostile environment is antithetical to learning;
4. scripts assuming that questions have "one" "right" "answer";
5. scripts that assume change is unexpected and is only "to be adjusted to;"
6. scripts which invariably show students as small, helpless, and weak, authority as overpowering, punitive, and perfect, females in roles of dependent servitude only, feedback and evaluation as necessarily negative;
7. scripts which use divergent words interchangeably, and which draw unwarranted conclusions;
8. scripts that appear unaware that even quite young students can have ideas of substance, as well as misconceptions, that they often discriminate between hypocrisy and integrity unfalteringly, that they resent being patronized and infantilized, unnecessarily dependent, and compulsively irrelevant, inappropriate empty motions, i.e. busywork.

Because of the above work, several scripts had been totally rewritten, and notations for debugging were complete by the time the hardware was ready for use at the elementary school location.

The first weeks at the console were spent in continuous rechecking, for computer time had not yet been used to make those corrections previously requested. After each afternoon period reserved for corrections, scripts were again checked. Elementary school materials were not first-priority materials, and at the end of several weeks there still was not one script that was accurate as to content, grammar and spelling, or workable as to programming.

At this time, a chance remark revealed the existence of another set of elementary scripts which had been written specifically for the sixth grade students in this school, concerning scheduling procedures at the junior high school they would attend in the fall.

There was always a great deal of interest in the console by the students at Hamilton, and the door was rarely without a cluster of boys who were hoping the computer would work while they were there to see. The classroom across the hall was in on so many of the service calls, failures, and adjusting activities, that it seemed desirable to plan a short discussion with these students and their teacher. The principal preferred not however, desiring that this be a sixth-grade activity only. There was little time left before the end of the field-test period.

Suddenly it became necessary for someone else to continue with the elementary school field test, for Gannaway had become ill. That report follows.

*Students' Interactions at Hamilton.* Six students used the system at Hamilton from June 10 to 13 and three from June 23 to 27. The group included three boys and six girls from sixth grade whose reading and verbal abilities and intelligence ranged from low-average to very high. They were scheduled to use the console for 30 minute periods for 3, 4 or 5 sessions. Persistent technical failures resulted in average sessions of 20 minutes with no individual having more than four sessions at the console.

The purposes of the Field activities at Hamilton were stated in the Eleventh Quarterly Report as being:

1. Identification of possibilities and problems involved in further development of the ISVD with elementary school students;
2. Identification of areas of profitable usage of the system's materials amongst these students;

3. Examination of student reactions, fears and fantasies in relation to the machine and identification of sources of these reactions, where possible;
4. Determination of the language-concept limitations of the present system for elementary school use (by grade level) and identification of factors which may differentiate those students who do use the system from those who cannot or will not.

In view of the severe limitations upon activities at this location it was decided to expedite interactions in the following manner: after completing the script "Introduction to the System," the supervisor executed a command (@STOP) which enabled the student to move directly to the Major Orientation Script (ORIENTI, STEP [illegible] thereby avoiding material that was considered irrelevant for elementary students.

ORIENTI, STEP 50, presents the question "What do you want to do today?" At this point the student was advised to type "Warren Junior High" since this data base was specifically designed for students at Hamilton which is a "feeder" school for Warren. From that point onward the student was free to direct the interaction.

Within this data base area the most frequently used scripts related to Seventh Grade Description, Academic Courses, Homework, Clubs and Club Preferences paralleling the concern which had been expressed by students in their initial meetings with the supervisor—classes, academic programs, homework, teachers, school size and meeting new friends.

*Students' Interactions with the System.*

1) Manipulation of Equipment
    a) These students proved to be very adept in their use of the equipment. One introductory/instruction session proved to be sufficient in almost all cases.
    b) The hardcopy (teletype) facility was used frequently. Some students were taking copies to show parents who were interested in their activities.
    c) As might be expected, some of the students had difficulties when they were required to compose and type

in their own responses. With multiple choice situations, where their responses required the pressing of only one letter or number key, they were quick and adept.

2) Motivation and interest
    a) Despite electro-mechanical failures and other frustrations, these students remained highly motivated and interested. Although sessions were relatively short (30 mins.) their interest and attention did not flag as had been feared by some prior to field activities.
    b) The interest of parents and teachers perhaps contributed to the students' continued interest. Parents seemed to be very supportive. But, on the whole, it seemed that the students' interest was self sustaining and satisfying to the individuals themselves.
    c) Several students reported that their friends were jealous and intensely curious about the inquirer's activities at the console.
    d) One student reported that she had asked her mother not to take her out of school on Friday afternoon because of her computer schedule.
    e) Students responded favorably to ISVD, even when the equipment was not functioning: "I like it! It's exciting! I love it! I wish it was working!"
    f) They were extremely enthusiastic when they received specific and detailed information—as in the Seventh Grade Description Template. Several were highly verbal and explicit in their comments, mostly to the effect that they had learned things that they would not normally find out until they had been at the new school a week or more.

3) Reactions to Content
    a) In terms of materials most-frequently copied on the teletype, seventh and eighth grade descriptions, Warren introduction, and scripts pertaining to courses, electives, homework, clubs and club preferences, seemed to be of most interest and value to the inquirers.
    b) The content of some of the scripts was found to be too general, being material which some of the users already

knew as a matter of general knowledge. Perhaps this would indicate that such material would be of more interest to students in an earlier grade. It would seem that here, as elsewhere, we have learned that we cannot take for granted that we know what students want to know and what is important to them.

  c) Nevertheless, students were generally enthusiastic about the information they did achieve and usually commented to the effect that they had learned things which prior trips to Warren, talks, and other introductory Services had not acquainted them with.

4) Reactions to the Equipment
  a) The youngsters had surprisingly little difficulty in relating to the machine in behavioral terms, although some had verbal difficulty in referring to it: "I can do things to it, her, him, whatever it is."
  b) The machine did not assume a quasi-human aspect for these students.
  c) Its presence evoked questions concerning its operation, its components and the general subject of computers.
  d) There was little evidence of the ambivalent awe which many older people experience in relation to computers. These youngsters are either accepting computers as tools or have not yet acquired the subtle fears that their elders have.
  e) Some of the terms used by the supervisor provoked enquiries and picturesque imagery (such as "a bug in the system" and "it bombed") but it seemed that the difficulty was more in the realm of relating common associations to these phrases to the computer, than in accepting the computer itself.

5) The Language-Concept Limits of the System
  a) The language level and most of the concepts of the Warren Scripts seem to be appropriate for Sixth Grade Students at Hamilton. With the exception of a few ambiguous frames, few major difficulties were experienced.
  b) The use of lists, multiple choice with short, easily typed option indicators (such as letters or numbers) seems to

work well with these students, since their typing skills are not highly developed.

c) The introduction to the system needs revision for use with Elementary School students, as was found to be the case at most locations. Interpretations and assistance with specific words and several of the instructions were frequently necessary.

d) The students themselves indirectly offered ideas that might prove useful in tailoring an Elementary School Information System. The idea that students might be used in some phase of the tailoring process would seem to be worth consideration.

6) Summary. Although the field test was of limited duration and users few in number, it is possible to identify some suggestions and indications in the observations of elementary school users and their reactions to the system.

Materials which seemed to have promise of usefulness were those which provided foresight of the kind of school these students might expect to move on to. However, since all the material they were exposed to dealt, in some way, with that school it is not possible to compare across data base areas.

For the most part, language and concept problems were few, but once again, this material was specially prepared. Where material was presented which had not been designed specifically for use with elementary school students (i.e., the introductory script) more problems were encountered.

Since only sixth grade students were used in this trial implementation, it was not possible to evaluate the limits of the language-concept functional utility in terms of grade levels. It was found that problems of maintaining interest and motivation were non-existent and that students at this level were quite adept in their use of the equipment within fairly broad limits.

Few inhibitions or fears were found to hamper students' relating to and using the System. Fantasies were surprisingly few, the students taking the computer very much in their stride. Indications so far are that an ISVD-like System would be possible and acceptable to elementary school students.

BIGELOW JUNIOR HIGH SCHOOL

At Bigelow the trial implementation got under way with pre-trial activities during the week of April 21-25. Followed by use of the equipment during the period April 28 to June 13.

Delays in going into the field, and those caused by faults and failures, caused the scheduling of users to be modified. Whereas it was originally planned to have groups of users scheduled for varying numbers and frequencies of interactions, it was later found necessary to schedule each user on a once-a-week basis. As a result, users interacted with the system an average of four times. The duration of interactions varied considerably with the amount of down-time caused by hardware and software failures. Thus, sixteen students used the system approximately four times each over a six week period.

Pre-trial activities included:

group discussion with students,
completion of Part 2, O'Hara-McSherry Test of Occupational Knowledge, (TOK)
Writing of a career development autobiography

The autobiography was required to address itself to the following questions:

i) What kind of person are you?
ii) How did you get to be that kind of person?
iii) What kind of career do you think you will go into?
iv) Why do you want to go into this career?

During their first interaction, inquirers were routed to the Occupational Preference Script. Post-trial activities, during the week June 9-13, included:

i) A second administration of the TOK, part 2.
ii) Writing of a second career development autobiography, with a fifth question to be answered: "Has there been any change in your choice of career and, if so, why?"

iii) Dorothy Kunberger, Head counselor at Bigelow, conducted two small-group meetings in which students were encouraged to discuss their experiences with the system, their reactions and any suggestions they might have for its improvement.

*Students' Interaction With System.*

1) Manipulation of Equipment
   a) For the most part, Bigelow students had few problems handling the equipment, although those without established typing skills were considerably slower with their input. The amount of assistance or direction that a student required or received from the Supervisor varied with several factors: the number of previous interactions and their duration, the quality of those prior interactions and the amount of frustration or inhibition resulting from technical fault or failures or from poorly executed scripts, the interest and motivation of the user and the quality of the system's functioning at the time in question.
   b) The usual practice was to allow students to explore the ISVD as freely and autonomously as possible for as long as possible, assistance or direction being given only when technical problems arose which the student seemed unable (or unwilling) to cope with. It was evident that some of the students had low "risk tolerance" and sought help at a much earlier point than others.
   c) Although most students used the hardcopy facility and the commands at some point or other, they were relatively slow to appreciate the power of the command language. Those who did recognize the power that the commands gave them over the interaction process usually succeeded in getting deeper into the system than those who did not. For the sake of this latter group, it would seem that the section of the introduction which deals with the commands might be elaborated somewhat so

that the potential power of this facility is made more obvious.

d) Bigelow students had little trouble following clear, unambiguous instructions but were often frustrated when the anticipated results of so doing were not-forthcoming. This was frequently and particularly the case with instructions to "push the 'run' button" in order to see a slide. The slide projectors rarely worked properly and, on the few occasions when they functioned properly at the mechanical level, irrelevant slides were displayed with depressing regularity. This was remarked upon several times during the post-trial discussions.

2) Motivation and Interest

a) Despite continual failures in both hardware and software, many of the students maintained a keen interest in the system—even to the point of coming to enquire after "its" health at odd times during the day and after school. However, there is no clear evidence that this was the result of progress made at the console or that it was related particularly to progress with any particular nexus in their career development. In fact, during post-trial discussion a great deal of frustration was expressed in this direction while, at the same time, students maintained that they felt the ISVD-concept to be a promising idea with wide-ranging potential.

b) Some of the students showed an understanding of the problems of developing such a system on a trial basis. During discussion in which one student complained about the scarcity of facts and data about certain jobs, several of the others raised so insightful considerations which appear to indicate that they are quite capable of evaluating a situation independently of any personal frustrations or disappointments they have experienced in the same situation. This would seem to auger well for aspiring systems developers.

c) As with the Hamilton students, the Bigelow inquirers reported considerable interest and support amongst parents and peers. Some brought friends along to see their "friend."

d) For whatever reasons, interest and motivation persisted. It is easy to believe that a well-functioning system would have been an outstanding success with these students. Where hard data actually was obtained they were usually extremely enthusiastic about the system.

3) Reactions to Content

a) The occupational and educational areas were most frequently accessed, in particular the templates and the preference and direct access scripts.

b) Very little use was made of the concept materials. When asked what they wanted to do, (ORIENTI, STEP 50) it rarely occurred to a student to say that he wanted to talk about self, or Decision-Making, or anything else which would lead him into the body of concept materials. A close examination of the introductory routines will show that this is not a surprising result since there is very little mention of such a possibility.

c) Some students interacted very effectively with the preference routines, developing highly sophisticated strategies for holding certain options or variables constant while manipulating others and then comparing the resultant job or college listings. Others, slower to grasp the mechanics of the procedure, frequently stated their preferences or self evaluations in such a way as to eliminate all relevant alternatives, with resulting frustration and irritation. For those who were seriously seeking data or "guidance" the explanation that the data base was necessarily limited for technical reasons proved to be of little impact.

d) Those who did succeed in obtaining data were usually impressed and frequently reported that they had learned about, or had found in their list, some job or college alternative which had not previously occurred to them. Thus, although the spectrum of alternatives had been dipped only in a very shallow fashion, when the system did function it did so effectively. A system which had devoted much more time and money to college and job preferences than was possible in this prototype ISVD, would be enthusiastically welcomed by most of these students. This became clear in their subsequent discussions.

4) Reactions to Equipment

- a) There is an interesting contrast to note between the Bigelow users' relations to the equipment and the Hamilton users' relations. There were many more anthropomorphistic references and "signs" of "emotional relationships" at Bigelow. However, this may be of no consequence. It could be, too, that the older students have had much more exposure to the science fiction renderings of "machine intelligence." (Even the Apollo 11 crew and flight controllers had named their computers "Hal"!) Whatever the explanation, most of the Bigelow students slipped into a casual camaraderie with "It," "Him" or "Her." Nicknames and pet-names were frequently used, and more than once alibis were offered for the machine during a phase of malfunctioning. At first, a few students were overawed by the idea of actually *using* a computer, and a few were afraid that system failures were a result of something they had done. However, this phase passed quickly with most users.
- b) One or two students had difficulty accepting the idea that there was a machine and not a person "at the other end." This seemed to be due to the way in which the machine responded in a relevant manner during early interchanges. By the end of the field trials, however, none still believed that there was a person at the other end!

5) Language-Concept Limits

- a) Once again, with a reduced sample and reduced trial period, there was little scope for any systematic observation of language and concept limits.

  Most of the students managed, most of the time, to follow and interact without difficulty.

b) One point, brought out in discussion, was that the symbols displayed on the Cathode Ray Tube (CRT) were difficult to read compared with the CRT display at ISVD home base. This difficulty increased when large blocks of texts were presented. Whether this could have been corrected by adjusting the brightener and definition on the CRT, or whether individual CRT's differ in this characteristic is hard to judge at this point.

c) The most frequent criticisms of the language/concept features of the system centered upon ambiguous and fuzzy instructions and definitions. Instructions were also said to be too complex, too involved for several of the users.

d) Some terms were apparently used without an accompanying definition and @HELP provided no clue. Although it is probably true, as some researchers have found, that a person who is interested and motivated can function at vocabulary-concept levels well above his "normal" functioning, it would probably be well worth the time and effort to study the vocabulary and concept levels of client populations when establishing a future ISVD in any specialized population or area.

e) Both at the console and in group discussion, students complained about and criticized the language, lengthiness and occasional obscurity of some of the instructional materials. In designing specialized systems, whether in the same or different geographic locations, a careful examination and field testing of test or procedural instructions should be carried out.

f) Students had useful comments about the range and depth of information as well as its organization.

6) Post-trial Interviews and Discussions

Since most of the field supervisors will be submitting detailed reports, including case studies and analyses of interviews and discussions, only brief summaries will be presented here.

a) In answer to the question, "What did you think of the system?" most of the Bigelow users expressed mixed feelings. Most common was the phrase: it would have been very good, if it had worked properly. Nobody, even in the unguarded moments of free interchange in the group discussions, doubted the potential value of an ISVD-like System.

b) At the same time considerable frustration was expressed *because* they felt the system was basically a good idea and could have been very useful to them. Those individuals who did get data they had sought were convinced, those who didn't were still convinced, but disappointed.

c) The natural language capacities of the system were welcomed and appreciated as a significant difference between this system and the more usual data-retrieval systems. However, they were aware that this capability was by no means fully developed—and said so.

d) Most frequent causes of frustration were: peripheral hardware failures and delays which ate into their interaction times; central hardware failures, similarly; software failures which included absence of data from templates when these were finally accessed, scrambled data, failures of the system at times to "recognize" input which had at other times been recognized; absence of help when the @HELP command was used; too frequent elimination of alternatives on preference lists without any timely advice being given to prevent too many repetitions; introductory and instructional materials too lengthy and often obscure or ambiguous; accessing too repetitive and clumsy.

e) Finally, most students agreed that the close scheduling forced upon them by a rigid school time-table added to their frustrations because they were unable to get deeply enough into the system in the allotted 40 minutes. Coupled with this, the necessity to start from scratch on each new session was particularly frustrating. The feature of the system which prevented the logging of progress through scripts from being stored until the @QUIT command had been input, meant that every time the system "bombed" the user had to begin again. It is suggested that a routine which would log progress automatically every 10-15 minutes would save a great deal of computer time and user frustration.

f) The students suggested that an initial familiarization and training period, prior to use of the system, plus an overview of its capabilities and functions would have been useful. It should be noted that the prototype character of the system and the attempt to demonstrate feasibilities rather than excellence was not lost on these students. On the whole their comments and criticisms were conscientious and constructive attempts to contribute to an improved Prototype III. Many would be glad to use the system for longer sessions on a long term basis if technological difficulties could be surmounted.

## NEWTON HIGH SCHOOL

*General Organization of Activities at Newton High School.* As noted elsewhere, delays in equipment delivery and installation caused a delayed start to field testing with a consequent curtailing of some planned activities. A week in April was used for trial demonstrations of the equipment and the system to which counselors and a small group of students were invited. The regular interactions of the field test began in late April and continued through to June 13 when the school year ended.

1. Student Subjects. Students were very carefully selected in order that several important considerations be met: a broad range of student age and ability and interest, a range of decision-making development and styles, a variety of discontinuities being represented within the group; time limitations dictated that [illegible] small number of students could be used if several, reg[illegible]actions were desired; a minimum of interference with t[illegible] high school operation was desirable. Consequently, 1[illegible] evenly divided by sex and by curriculum levels (I [illegible]) within the eleventh grade, made up the User group. Eleventh grade students should be involved in discontinuities concerning post-high school planning to some degree and curriculum levels I and II were recommended by the Newton Guidance Office as a means of avoiding reading and language difficulties with students

in lower curricula. Curriculum I is primarily a college preparatory program. Curriculum II is oriented toward 4-year or junior college, or specialized schools and business work after high school.

To avoid disruption of regular school schedules students were chosen who had a free study period available during the scheduled systems time. Students were also selected in such a way that each counselor in the school was represented by at least one counselee in the user group. Finally, educational history data were available in retrievable form for students who had attended Bigelow Junior High School prior to Newton. Thus, only students who had attended Bigelow were selected. Counselor evaluations of decision-making development and current concern with career oriented discontinuities were sought and taken into account in selecting students. From a pool of 64 potential field test users an initial group of 16 were selected.

*Table 1*

Distribution of Initial Candidate Pool,
by Sex and Curriculum Level

| | Curriculum Level | | | | | |
|---|---|---|---|---|---|---|
| SEX | I | I-II[*] | II-I[*] | II | NA | Totals |
| Male | 13 | 5 | 1 | 12 | 0 | 31 |
| Female | 13 | 9 | 0 | 10 | 1 | 33 |
| | 26 | 14 | 1 | 22 | 1 | 64 |

[*] Levels I-II and II-I designate mixed programs, dominant curriculum first.

Letters were sent to 16 students and later to parents. Only 5 students could not or would not participate and 5 more from the initial pool were contacted. No parent refused permission for their child's involvement. The final composition of the field test group is shown in Table 2.

*Table 2*

Distribution of Field Test Group by Sex and Curriculum Level

| | Curriculum Level | | | | |
|---|---|---|---|---|---|
| SEX | I | I-II | II-I | II | Totals |
| Male | 0 | 3 | 1 | 4 | 8 |
| Female | 2 | 3 | 0 | 3 | 8 |
| | 2 | 6 | 1 | 7 | 16 |

Availability of free periods and desire to have each counselor represented cause the slightly uneven distribution across curricula levels.

2. Interviews. Students were interviewed about education/vocational decision making three times: 1) in February/March, prior to field activities and prior to receiving counselor estimates, 2) in Mid-May approximately midway through the field activities, and 3) Mid-June, at the conclusion of the field test. The initial interview concerned students' perceived decision-making in vocational/educational areas. Topics focussed upon included, important decisions being faced or anticipated, alternatives under consideration, reasons for preferred alternatives, occurrence of specific choice, degree of commitment to specific choice, (if present), rejected alternatives and reasons, decision-making activities including influence of others, general considerations for the decision and perceived obstacles to implementing choice.

The second interview reviewed topics discussed in the first. Additional questions were asked to obtain information about the current status of the decision and changes noted in the importance assigned to the decision, alternatives considered, off-line decision-making activities and current plans.

The third and final interview followed the conclusion of the field test period. The organization of this interview differed from the others. During field testing, supervisors had kept a log of inquiries directed by each student to the system and system's activities engaged in. The final interview focussed upon the relationships, perceived by the student, between issues raised in earlier interviews and questions brought to the system and activities at the console. Materials from interviews and interaction records were reviewed with the student. Relationships perceived by the student were explored and discussed. A case study analysis of these interviews is being developed by Aylmer and will be presented more fully elsewhere.

*Observations and Discussions of Interactions.* Records were kept during interaction sessions of responses directed to the system, comments and questions directed to the supervisor and of the supervisor's impressions of student reaction to the system, plus other relevant events. Most sessions were discussed immediately following termination of an interaction. Some of the questions asked were formulated on the basis of observations made by the supervisor during that interaction or earlier ones.

*Students' Interactions with System.*

1. Frequency of Usage of System.

Table 3 shows frequency distribution of interactions:

*Table 3*

Distribution of Interactions

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. of Sessions | 0 | 1 | 2 | 3 | 4 | 5 | 6 | >6 |
| No. of Students | 0 | 0 | 3 | 3 | 6 | 2 | 2 | 0 |

N = 16 students

Modal number of sessions: 4
Mean session of student: 3.2

Table 4 shows the number of sessions actually held as compared with the theoretical maximum number of sessions, (98, in a 31 day period), together with reasons for discrepancies.

*Table 4*

Field Test Sessions

| | | Number Actual | Percent of Maximum |
|---|---|---|---|
| Sessions Held | | 61 | 62 |
| Sessions Missed | | (37) | (38) |
| Reason: | System failure | 10 | 10 |
| | Students cancelled or didn't show | 24 | 25 |
| | Schedule conflicts | 3 | 3 |
| | Total Sessions Scheduled: | 98 | 100 |

Note that "system failure" covers sessions which were completely lost by reason of hardware failure. It does not indicate proportion of time lost during sessions as a result of hardware or software failures.

2. Usage of Materials. In these 61 sessions, students sampled a variety of system components (scripts) and data files, but concentrated their efforts primarily in the college and occupation areas. Table 5 summarizes how the system was used, by data file and script type:

Direct Data Access and Preference scripts were used with approximately equal frequency by students, although if Template scripts are included as Data Access, these scripts predominate by a ratio of 3 to 2 over Preference scripts. These three script types (Data, 29 uses; Template, 4 uses; and Preference, 28 uses together accounted for over 70% of all system component use (excluding introductory materials about the system itself). The frequencies of use of the remedial scripts Helpname (to suggest possible alternatives to the student, similar to a Preference script;

### *Table 5*[1]

### Use of System Components

| | Data File | | | | | | |
|---|---|---|---|---|---|---|---|
| | Occupation | College | Trade School | Military | Self | Game | Totals |
| *Script Type* | | | | | | | |
| Data | 7 | 21 | 0 | 1 | 0 | — | 29 |
| Template | 5 | 9 | 0 | 0 | — | — | 14 |
| Helpname | 3 | 5 | 0 | 0 | — | — | 8 |
| Helpvar | 1 | 5 | 0 | 0 | — | — | 6 |
| Preference | 6 | 16 | 6 | 0 | — | — | 28 |
| Overview (Concept Scripts) | 0 | 4 | 0 | 2 | 0 | 3 | 9 |
| Explore | 0 | 2 | 0 | 0 | — | — | 2 |
| Clarify | 1 | 0 | 0 | 0 | — | — | 1 |
| DOT | 2 | — | — | — | — | — | 2 |
| SCPT | — | — | — | — | 0 | — | 0 |
| Totals | 25 | 62 | 6 | 3 | 0 | 3 | 99 |

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[1] In Table 5, use of a script is defined as gaining entry to the script and interacting with it. Use of a data or template script may include multiple questions about multiple alternatives. Use of a preference script consists of a complete or partial sequence through the sorting procedure. Thus, if a student typed @DATA-COL, and asked questions about the cost of two different schools, this is counted as one use of the data script for colleges. If, however, he goes through the job preference script twice in succession, to explore the implications of making different choices, this is counted as two uses of the preference script for occupations.

8 uses) and Helpvar (to suggest information categories; 6 uses) should not be interpreted to mean that students required assistance only one-third of the time while using Direct Access scripts. Most students did need assistance with Direct Access components, but use of helping scripts was discouraged by supervisors after initial experience suggested that they more often than not added to students' confusion. In cases where students either did not know or could not communicate a job or school name to the system, the supervisor directed the student to a hard copy master list of names in the data file, or suggested the appropriate preference script (see below for further discussion of intervention by supervisors).

The relatively low frequency of use of Overview scripts reflects the tendency of students not to phrase requests in terms of specific information needs. Questions like "tell me about college costs" or "What are job interviews like" just weren't asked, although one student did inquire about "location of colleges" and "size of colleges," and felt the materials were very helpful.

Other scripts, including the access routines Explore and Clarify, the D.O.T. Job Exploration, the Career Game, and the Self-Concept Profiling Technique (SCPT) were used very infrequently or not at all. All of these scripts remained in preparation until late in the field test period, and were therefore not adequately linked with orientation (routing) scripts.

Table 6 suggests that a direct relationship may exist between number of sessions and the number of areas worked on. This might be a result of students' wanting to "learn the ropes" by exploring all facets of the system rather than focussing early on a specific area of intensive use. Alternatively, a threshold effect may be in operation as a result of which students generalize their learning and experience after a certain number of sessions or when nearing a termination of the field test period. A critical number of sessions and/or varied experiences with the system may be necessary before consideration of multiple decisions within the system takes place. On the other hand, students with high frequency use (four or more sessions) seemed as likely to concentrate in one salient area as in a variety of areas.

*Table 6*

Number of Data Files Requested by Student vs.
Total Number of Sessions

| | | Data Files Requested | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| Number of Sessions | 2 | 3 | — | — |
| | 3 | 1 | 2 | — |
| | 4 | 3 | 2 | 1 |
| | 5 | — | — | 2 |
| | 6 | 1 | — | 1 |
| | Totals | 8 | 4 | 4 |

Not all requests for data files were acted upon. System shutdowns or failures, rigidity of school timetables and computer schedules, frequently interrupted sessions at critical times.

The length of introductory procedures probably caused the several delays of requests to data bases until the second interactions. These students who came to access more than one data base seemed to be those who also got off to a quick start with the system.

Discussions with students indicated that they would have liked to have more time to explore the system and to return to it in the coming year. It can only be conjectured what usage patterns might emerge had more field test time been available. Indications are that, over and above the frustrations of delays, time-out, repetitive initiation procedures and introductions, the system will prove to be useful in longterm use.

3. Reactions to the Equipment
   a) Reactions to the system range from pleasure and fascination to nervousness and unease at being asked questions by a machine.
   b) Several students were struck by the pseudo-human "personality" of the system and there was evidence in the wording of their reactions that they had a little difficulty

deciding whether or not to use personal pronouns in references to "it."

c) On the whole, as students became more familiar with the manipulation of equipment, they were favorably impressed with the equipment, ignoring delays, etc.

d) The Newton students seemed to accept the machine, per se, very quickly and their responses were soon directed beyond the appearances of the system to its structure, functions, operations and content.

4. Reactions to Content

a) Initial sessions usually entailed some confusion and frustrations. Introductory and instruction materials, especially unidentified preambles, were confusing.

b) ORIENTI, Step 50, caused difficulties here too, although several of the students soon came to terms with the ambiguity and openendedness of the question, "What do you want to do?" This was probably a function of the laissez-faire and non-involvement stance of the supervisors which forced students to "find out what happened."

c) The system's sporadic failure to use available word listings appropriately for correct routing decisions together with incomplete anticipation of necessary dictionary lists, and the absence of adequate @HELP items in several places contributed to frustrations on several occasions. Students seemed to develop a reliance upon supervisors or on the @DATA commands, in these situations. Frequent use of the commands seemed to result from a) early instruction in their use, b) prominently displayed instructions, c) frustrations experienced in communication via natural language.

d) Two-thirds of all systems use at Newton was concerned with college choice. The remaining third was primarily directed to occupations with minor use of military and trade school materials. Half of the students concentrated their efforts in one area—five on colleges, one on job, one on military, and one on trade school. Of the remaining eight, four engaged themselves in three different areas, and four worked in two areas.

e) Reactions to content were varied. Those who obtained relevant data without much difficulty were enthusiastic. Others were frustrated by the limited scope of available data—when told by the machine "no data available."

f) Some of the overview scripts were used but none of the concept/teaching scripts. The Life Career Game and the Self Concept Profiling Technique were not sufficiently well developed to be accessed until late in the field test period.

g) Suggestions by students for improvements in the system included a number of comments similar to those at Bigelow with regard to making the system more "personal" and having it take account of the individual personalities, interests and preferences of the inquirer as opposed to standardized preference alternatives and pre-determined "relevant" criteria.

5. Language-Concept Limits. The vocabulary and concepts caused little difficulty in the body of the accessing, preference and template scripts. Some confusion resulted from the introduction materials and the format of some instructions, but on the whole the language used in ISVD seemed quite well pitched for Newton students.

6. Summary.

a) In terms of interaction time and accessing, Newton's field test activities were quite successful. System down-time aside, delays, failures, etc., accounted for slightly less time at Newton than elsewhere. Students' vocabulary and reading levels were higher at Newton than the other schools and the system's vocabulary much more suited to these students.

b) Nevertheless, the same shortcomings appeared here as elsewhere, although their overall effect upon the students was perhaps less. Introduction and instruction materials and format were found to be confusing and somewhat obscure; ORIENTI, Step 50, again caused problems; inadequacies in dictionaries for understanding and for routing decisions showed up and the lack of @HELP facilities at appropriate places was noticeable, perhaps because of the greater use of the commands encouraged at this location.

c) Nevertheless, students seemed generally to be favorably impressed by the ISVD. Its college and jobs data bases were frequently used and were criticized only in terms of their limited scope.

d) Commands and accessing received a fairly thorough workout and some of their inadequacies were demonstrated.

e) Again it became apparent that the introductory materials were too slow and too long in relation to their clarity and helpfulness.

f) Again, also, the need for a routine providing rapid return to a cut-off point, without a repetition of preliminary routings and preamble, was demonstrated.

## WESTERN METROPOLITAN BOSTON REGIONAL OPPORTUNITY CENTER

1. General Situation. WEMBROC was given relatively low priority in the schema for bringing installations up to operational standard. Also particular difficulty was encountered in getting the equipment functioning once it had been delivered and installed. Scarcity of the specialized replacement parts resulted in long delays whenever equipment failed at any location. Consequently, while WEMBROC was not in use the equipment was cannibalized to service Bigelow and Newton.

The interplay of periods of non-functioning and unavailability of parts, with lack of users at WEMBROC, delayed field testing through to 26 June. The week of 14-21 June. the computer was not available for ISVD use.

Use of the system at WEMBROC took place during the week following 26 June. Two more students from Waltham Vocational High School (ages 16 and 17) used the system for 8 hours each. One 17 year old female volunteer used it for 6 hours.

By 28/29 June, WEMBROC activities were overlapping and interfering with preparations for An Invitational Conference on Computer-Assisted Guidance Systems and difficulties were experienced in simply keeping the system running. It was therefore decided to abandon WEMBROC activities at this point.

2. Reactions to Equipment
   a) As was the case with students elsewhere the WEMBROC users were a little tentative in their initial usage of the equipment. They were also intrigued and pleased by the opportunity to use a computer.
   b) They were impressed by the variety of facilities available: data phone to establish contact with the machine (which intrigued them), teletype copier, slides, etc. However, the slide projectors and teletype never worked throughout their interactions with the system.
   c) Few problems were encountered in their mastery of the use of the equipment although the male students were much slower in their input than the girl, who had some typing skill.

3. Reactions to Content
   a) Initially the natural language capacity and the illusion of understanding on the part of the machine considerably impressed all three users. Even after some of its shortcomings had become apparent it was still noted as "a neat trick."
   b) The Trade School materials proved to be in poor shape and sadly in need of editing and debugging. The students became quite discouraged after the second occasion when a template and a direct access routine provided garbled text and gaps where data should be. This happened with one or two of the jobs they attempted to get data for. (It was later discovered that this was a hardware problem rather than a software failing.)
   c) Of five passes at the occupational preference routine, one boy eliminated all the alternatives on his list three times, obtained one list of jobs which bore no relation to his interests and desires, and one on which one or two jobs seemed to be even remotely relevant. The fact that "cook" appeared on one list seemed to upset him considerably more than the 4 or 5 long delays caused by system failure

—he had aspirations in the field of electrical engineering! His whole attitude to the system was colored by this experience from that point on.

d) The most encouraging response to the system was: "It would probably be useful if it worked." The poor impression created was understandable since that proved to be a bad day for system failures, garbled messages and general malfunctions. Nevertheless, all of the users indicated that they thought the idea was good and potentially useful to students and job-seekers.

e) No concept scripts were used, Trades schools, college and occupations being the three areas used.

4. Language-Concept Levels. Except in the introductory and some instructional materials, there were few problems with language or concepts. The female user had none at any time. The manner of presenting previews or preambles caused more confusion than the vocabulary or concepts involved.

5. Summary. The field test activities at WEMBROC were severely limited, timewise and seriously interrupted by technical problems. As a result, little favorable impression was created in the users.

   The materials in the trade school area need editing and debugging.

   Language-concept levels and manipulation of equipment raised few problems apart from those found in all the other groups: introduction, instructions and ORIENTI, Step 50.

## HARVARD GRADUATE SCHOOL OF EDUCATION

We intended from inception of ISVD to have career material available for use by adults. Adults were to interact with the system both at the Western Metropolitan Boston Regional Opportunity Center (WEMBROC) and the Harvard Graduate School of Education (HGSE). These two groups were picked to provide both a reasonably verbal and a possibly less verbal group for interaction in the system.

The field test with the WEMBROC group is reported above. This sub-section reports on the field test with students at the Graduate School of Education.

The ISVD concept calls for inclusion of choices at a time when placement is necessary. Placement files were consequently constructed for two groups, high school students and the HGSE. As the project developed, placement as high school ended was given higher priority than graduate school placement because experimentation with those who might not go on to college was considered the more important. This was the group likely to be seeking jobs at the end of high school.

The time and money resources available to implement the ISVD intentions did not permit completion of the HGSE placement file in time for the field test. That possibility first became evident during December 1968. Tiedeman therefore had to devise a new plan for using HGSE students in the ISVD.

Tiedeman was scheduled to teach at HGSE the course, Tests and Measurements in Educational Decision-Making during Spring Term, 1969. This course normally mostly enrolls students qualifying for the degree of Master of Education through the Program in Guidance. Since we had not yet experimented with giving counselors in training an experience in the ISVD, Tiedeman decided to combine the need for a field test at HGSE, which had to take place under the unusual conditions of availability expected in the assembly of the ISVD and its equipment, with the opportunity to involve beginning counselors in the ISVD. He therefore turned his course in Tests and Measurements in Educational Decision-Making into what for all intents and purposes became the course, Man, Machine, and Career in Elementary Perspectives.

The revised course started on 4 February and continued through 15 May 1969. The outline which was framed at the beginning but followed for the most part throughout the Spring Term is as follows:

### G-50. Guidance: Man, Machine and Career in Elementary Perspectives

I. Introduction: Man, machine, and career in elementary perspectives—Tiedeman

II. A machine—Tiedeman

III. The computer as many machines
  A. Calculation—Tiedeman
  B. Linguistic logic
    1. Simon ⎫
    2. Weisenbaum ⎭ —Tiedeman
    3. Ellis and Pincus—Ellis

IV. A machine and education
  A. Can a machine develop a career?—Tiedeman
  B. Can a machine counsel?—Tiedeman
  C. Can a machine admit an applicant to continuing education?—Tiedeman

V. The Information System for Vocational Decisions
  A. Data files—general—Durstine
    1. Occupation and military—Durstine
    2. Education—O'Hara
  B. Teaching scripts—O'Hara
  C. Games—Archibald
  D. Flexible grouping valuing procedures—Hutchinson
  E. SCPT valuing procedure—O'Mahoney
  F. Access routines—Aylmer
  G. The system—Roman
  H. Writing and implementing scripts—Roman
  I. Placement—Brown

VI. Laboratory on ISVD—Higgins with Aylmer

VII. Symposium on field test results—Field test supervisors

VIII. Implications
  A. Counseling practice and preparation—Higgins and Tiedeman
  B. High School 1980—Tiedeman

In addition, the students were given the following writing assignments:

1. (After six weeks.) Submit a paper of no more than 10 double-spaced typewritten pages on the subject, "Man, Machine, and Education."

2. (After ISVD lab experience.) Complete and turn in laboratory assignment consisting of:
   A. Detailed criticism of parts of the ISVD system with which you interacted
   B. A script which you prepared in order to improve a place in the ISVD where you considered improvement to be essential.
3. (At end of course.) Submit a paper of no more than 20 double-spaced typewritten pages on the subject, "Implications of 'Man, Machine, and Education'." It is intended that you revise and sharpen your earlier paper on "Man, Machine, and Education" and write this time about the implications of your concepts for various phases of education.

The major part of the course was planned with realization that the ISVD would not be implemented in time to give the students much time at the consoles themselves. This first part of the course therefore proceeded on schedule. However, the grant renegotiations, ordering and provision of equipment, and implementation of the system all took so much time that in the end the laboratory for the HGSE students had to be markedly curtailed. This curtailment was accomplished by dividing the students into two groups, those with interest in use of the system with younger subjects and those interested in its use with adolescents and young adults. Gannaway took the group of students interested in children and worked with them in reviewing and revising the Summer 1967 scripts which was then her assignment in the project. Gannaway was particularly interested in infusing into those scripts her understanding that it is not alone *what* you say which produces an effect, it may well be a still greater degree *how* you say it. O'Mahoney took the group interested in adolescents and young adults. He was at that time busy both in writing scripts which would enable the administration and scoring in the ISVD of his Self-Concepts Profiling Technique, which the HGSE students had taken without benefit of computer, and in planning and conducting the field test at WEMBROC. He therefore, had the students help him in script writing and in thinking about using the ISVD with less verbal inquirers. In addition, both staff members worked with Higgins, who was Tiedeman's teaching assistant in the course and gave overall direction to the laboratory experience, in giving the students what little time they received in actual interaction with the ISVD system. The project priority which at this time was being given to keeping the Bigelow and Newton High School field tests operative at any cost to other plans meant that the HGSE students as well as Hamilton and WEMBROC inquirers gained little experience in the system itself.

The three writing assignments completed by the HGSE students provide valuable data on the ISVD, data which of course are of a formative, not a summative, evaluative nature. The last two papers of all the students have been kept. However, the first papers of only two students were kept. This was done because those two first papers were rather interesting statements of the concept of man, machine, and career. One of the papers was in the form of an internal dialogue which illustrated the effect which the ISVD sought. The second was a statement of the affect which the ISVD ought to try to emulate. This statement was done in terms of childhood experience which is a scarce area of experience for the system. These two papers also provide indication of the way in which a first effort was changed into a second effort. The paper on the dialogue was merely expanded so that implications also became a part of the internal dialogue. The second paper written by the student who illustrated needed system affect in her first paper was not very similar to the original effort; it dealt more with implementation of the ISVD concept, less with the affect associated with the system.

The final set of 12 papers which have all been kept indicate that the students were in general captured by the possibility that the concept of the ISVD might be internalized as a general heuristic and support 'machine' in life. For the most part the students seemed willing to accept the ISVD in their counseling activities. Students felt that they could work with the ISVD; not that it would work against them. They were also willing to face the fact that availability of the ISVD would mean change in the role of the counselor.

The other set of 12 papers constitute student reports on their

ISVD laboratory. A few students merely elected to take a particular script or two and to criticize it. Most of the criticism was of our teaching scripts which were originally written in a programmed instruction way. These scripts were rightly branded as more telling than process oriented. However, several good suggestions for revision were made.

Several students tried their hands at providing new scripts. All efforts lacked the detail which would finally be necessary to implement the ideas originally set down. However, all efforts caught the general idea of writing scripts so that a personalized scenario results when an inquirer brings himself into interaction with the programmed script. One new script is especially noteworthy. This script represented a suggested revision of some of the system material in which preferences are given for particular things. The revised procedure made little use of the computer capacity to store prior preferences; instead it relied more on the computer's capacity to give the person repeated, immediate experience with stating preferences and revising them in order to vivify the procedure of giving preferences. This script is being saved for heuristic use in thinking about Prototype III of the system.

As the revised course was planned it was believed that Tiedeman's students might also serve as critics of the HGSE placement datafile which was to have been implemented by the time the laboratory period was on. Our time and money resources never made implementation of that file possible. Consequently, Tiedeman's students never had opportunity to interact in a formative way with it. Furthermore, Professor Oliver's students who were supposed to have access both to the system in general and to the HGSE placement datafile as well, never did get opportunity to use either.

## SUMMARY OF TRIAL IMPLEMENTATION ACTIVITIES AND DISCUSSION

1. The time spent in the field was very much less than had been planned. Consequently, several strategies could not be employed (e.g., varying the number and frequency of interactions, studying long-term users' interaction patterns and

seeking developmental changes in decisioning and strategizing in relation to career).

2. For several reasons, the activities at Bigelow and Newton High School were more methodical and intensive than elsewhere. WEMBROC and HGSE were the least active and least successful of the field test sites.
3. Viewed as a *service* to its users, the ISVD was far from successful. Vital functions and processes worked eratically, hardware and software both failed frequently causing unacceptable delays at the console, the time-sharing function—basic to such a service—proved to be unreliable when more than four Inquirers used the system simultaneously. BUT, this trial implementation was not intended to be considered as a service to a client. This has been repeatedly and publicly stated. Nevertheless many of the system's critics have viewed the system from this standpoint and have compared it unfavorably (and rightly so) with systems which were intended to, and do, provide just a data processing service to aid in occupation or college choosing. Obviously it is pointless to criticize something for not being what it cannot yet be.
4. One point should be made clear and explicit at this juncture in relation to the comparisons drawn between ISVD and other functioning systems. The ISVD is not and was never intended to be a simple data processing-retrieval system. It has always been intended that the ISVD should be an INFORMATION GENERATING system, where that phrase relates to the process of helping an individual to achieve meaning (personal, significant meaning) by bringing facts and data about self and the world into relationship with already existing meanings (information) such that new understandings are attained.

To contrast the Information Generating System (very crudely) with a Data Processing and Retrieval System: the latter requires that the individual inquirer know what his question is and be able to state it specifically enough, in the terms of the system, for the system to be able to accept it and process and retrieve data to answer the question; on the other hand, the information generating system is more concerned with explicit, specifiable questions *as its end product*. The primary concern of the information generating system is the catalyzing of semantic and logical processes, experiencing and learning in such a way as to bring about clearer understandings of situations, issues, problems and self on the basis of which "right" or "good" questions may be asked of the Data Processing System.

5. Previous annual reports, the original proposal for ISVD and several of its Project Reports and other papers have, collectively, pointed to dozens of separate functions and processes which are relevant and necessary to an ideal information generation system. It has been the stated goal of this information system to attempt to operationalize as many of these features as proved possible for a Prototype II implementation. This is the implementation with which this report is concerned. Feasibilities have been at issue, not elegance, efficiency, economic viability or validation of theories of human behavior. It is in this frame of reference that we should consider the generalized account of our activities in the field presented above and the more detailed and systematic evaluations which are in preparation.
6. Students, student-counselors, counselors, teachers, parents and interested others, have all agreed that the goals we have been attempting are worthwhile and desirable. They and the ISVD personnel are equally agreed upon the fact that what we produced was not the most flattering and successful demonstrations of our concepts and purposes.
7. Nevertheless, we have clearly demonstrated that it is *possible* to:
    a) interact with an inquirer in a natural language medium;
    b) interact with several inquirers simultaneously;
    c) recognize and respond appropriately to individual requests;
    d) carry on a discourse such that an inquirer may progress from a general statement of his need to a specific

statement which enables a data base to be addressed and relevant data to be retrieved;
e) provide additional data which was not specifically requested, but which appears to be relevant;
f) operate in relation to several data files, and to move from one to another, on the basis of analysis of the natural language input or more artificial command language;
g) provide facts and data at various levels of specificity to suit the mode in which the user is operating;
h) Present textual teaching-type materials with visual supplement where appropriate or on demand;
i) to branch and link literally and vertically through numerous teaching-type scripts and from these to other routines such as direct access, preference or template scripts so that specific facts or data may be obtained to clarify a particular point when most relevant and useful;
j) present complex evaluative and heuristic procedures;
k) keep track of (monitor) an individual's movements through the system and store records of these movements;
l) use these records in order to:
  i) provide summaries of interactions,
  ii) use summaries of previous interactions for purposes of review,
  iii) tailor, to some extent, the presentation of materials on successive passes through the same scripts or routines;
m) use specific stored records (such as stated preferences or self evaluations) at a later time to compare with current statements of a similar nature in order to illustrate change, development, inconsistence or other aspects of the user's interactions.

We have, in fact, demonstrated that many of the desired features of a computerized guidance system may be operationalized right now.

8. One fact has become increasingly clear as the ISVD has developed: a truly interactive man-machine system for individualized instruction and guidance is unlikely to be achieved without a well developed "natural language" processing system.

Although our own language, GLURP, is still somewhat crude we have observed and experienced tremendous advances in our capacities to implement our necessary and our desirable functions as the language has been developed and improved. If one achievement alone had to represent ISVD's activities, then perhaps this should be it.

9. In a very real sense, the field testing has been a testing of GLURP, at least at the highly visible interface between user (or observer/critic) and the system. In terms of demonstrating feasibilities, the trial implementation has been a success.

   In another sense, too, it has been successful since it has shown quite clearly many ways in which system content, functions and processes need revision or improvements. Since another of the stated goals of the trial implementation was that of assessing the system for the purpose of incorporating recommendations and specification for a better system in Prototype III, this too has been achieved.
10. Some of the needed modifications were incorporated into the system during the field trials, others have been included since, and yet others exist in specifiable form.
11. Although it is true to say that ISVD is not yet a well-functioning system, we may now claim that we have developed the raw materials and techniques out of which to fashion a viable information system for career planning and development in relation to specialized user-populations (say junior and senior high schools in Massachusetts, Technical Schools in Massachusetts, Texas, and Wisconsin, or ghetto unemployed).

## *Activities: Administration of the Project*

### *Professional Personnel*

Robert O'Hara, Executive Director; Sara Booth, Sheila Leahy, Nona Strauss, David Tiedeman, Helen Topping

BUDGET

Budget negotiations for the final seven months were delayed two months. Final signing of the grant did not occur until the end of January. Our funds were reduced by approximately 15 percent. However, an additional sum was received to continue field testing and dissemination activities during the summer of 1969.

A request for extension of time until 31 March 1970 without additional funds is now being forwarded to the Office of Education.

COMPUTER SYSTEM

The critical negotiations for Digital Device Controllers with Sanders Associates were delayed two months because final signing of our grant did not occur until the end of January. This two-month delay caused us to defer field testing until April.

Negotiations for disposal of equipment are now underway.

PERSONNEL

As noted last year, we have invested considerable funds in the education and training of our personnel. Many of them were under pressure from outside sources to accept positions similar to ISVD. During the year, five full or part-time people were lost to competing projects. The loss meant a diminution in the quantity of the work we had intended to complete. Training new people was impossible in the short period of time left to us.

RELOCATION

It is hoped that the ISVD will at least continue in reduced capacity through 31 March 1970 without additional funds. The extension of time is needed to complete and forward documentation of the ISVD and to complete, reproduce and distribute final project reports and technical memoranda as well as this Third Report.

The completion of the project will have to be accomplished at a markedly smaller rate of expenditure. The project is therefore being moved to smaller quarters and will henceforward be associated with the Center for Educational Software Development of the New England School Development Council. The Center arises from the sale of the NEEDS to the Westinghouse Learning Corporation effective 1 July 1969. Since the NEEDS originally gave rise to the ISVD, it is appropriate that its infant Center inherit its potential as this Phase I of the development of an Education Machine draws to a close.

In the future, correspondence with the ISVD should be addressed to:

Information System for Vocational Decisions
NESDEC Center for Educational Software Development
55 Chapel Street
Newton, Massachusetts 02160

# IV. Authority and Personnel of the Information System for Vocational Decisions

## AUTHORITY OF THE INFORMATION SYSTEM FOR VOCATIONAL DECISIONS

### *In liaison through the United States Office of Education*

Norman Boyan, Acting Associate Commissioner, Bureau of Research, Office of Education (1969)

R. Louis Bright, Associate Commissioner of Research, Office of Education (through 1968)

Clay V. Brittain, Project Officer, Human Resources Branch, Division of Adult and Vocational Research

David E. Bushnell, Director, Division of Comprehensive and Vocational Education Research

Lawrence G. Gobel, Acting Branch Director, Basic Studies Branch, Division of Comprehensive and Vocational Education Research (Jan. 1968-     )

Eunice Jones, Project Officer, Human Resources Branch, Division of Adult and Vocational Research (through November, 1966)

Richard B. Otte, Project Officer, Human Resources Branch, Division of Adult and Vocational Research (Dec. 1966-Oct. 1967)

David Pollin, Deputy Associate U.S. Commissioner (Research)

Alice Y. Scates, Branch Director, Basic Studies Branch, Division of Comprehensive and Vocational Education Research (through Dec. 1968)
Senior Program Associate, Program Planning and Evaluation, Bureau of Research (Jan. 1969-     )

Judith D. Weinstein, Project Officer, Basic Studies Branch, Division of Comprehensive and Vocational Education Research

## *In liaison, Division of Vocational Education, Department of Education, Commonwealth of Massachusetts*

Walter Markham, Director of Bureau of Vocational Education

John P. Morine, Member of Advisory Committee; and Senior Supervisor, Occupational Information and Vocational Guidance

## *In liaison through the Office of the Dean, Harvard Graduate School of Education*

Jane Batchelder, Administrative Assistant in charge of Personnel (through 1968)

Herman F. Eschenbacher, Member, *ex officio*, of Advisory Committee (resigned June 1967), Librarian; and Lecturer in Education

Dorothy A. Johnson, Administrative Assistant in the Office of the Dean

Edward G. Kaelber, Associate Dean (resigned February, 1968)

Paul A. Perry, Assistant Dean

Gertrude Rogers, Administrative Assistant in charge of Personnel

Richard R. Rowe, Associate Dean (February, 1968- )

Theodore S. Sizer, Member, *ex officio*, Executive Committee, and Dean

Richard C. Wheeler, Associate Director of Placement

Ronald Wormser, Assistant to the Dean for Administration

## *In liaison through the New England School Development Council—New England Education Data Systems*

Raimond Bowles, Director of Finance, NESDEC

Richard Goodman, Executive Secretary, NESDEC-NEEDS; Chairman, Board of Directors, NEEDS (through summer 1969)

Hilton C. Holland, Chairman, Executive Committee, NESDEC

Robert Ireland, Executive Secretary, NESDEC (summer 1969- )

Eugene Park, Director of School Services, NEEDS

Michael Wilson, Executive Officer, NESDEC-NEEDS (resigned 1969)

### *In liaison, Western Metropolitan Boston Regional Opportunity Council (WEMBROC)*

Joseph H. McPherson, Manpower Director

### *In liaison, Technical Institutes*

Paul Berwick, Admissions and Counseling, Springfield (Massachusetts) Technical Community College
Richard Borowski, Counseling Center, Milwaukee Technical Institute
John Bugbee, Biomedical Technical Instruction, Springfield (Massachusetts) Technical Community College
Jimmy Hunter, Paul Quinn College (Waco, Texas)
Elmer Kuntz, James Connally Technical Institute (Waco, Texas)
Thomas Penkwitz, Computer Area, Milwaukee Technical Institute
Dennis Redovich, Placement Center, Milwaukee Technical Institute
Alfred St. Onge, Computer Systems, Springfield (Massachusetts) Technical Community College
Theodore Talbot, Paul Quinn College (Waco, Texas)

### *Advisory Committee*

†*E. Gil Boyer (resigned April, 1966), Administrator, NEEDS (June, 1963-June 1966)
Charles T. W. Curle, Professor of Education and Development, Harvard Graduate School of Education
†*Russell G. Davis, Professor of Education and Development; Research Associate in Center for Studies in Education and Development, Harvard Graduate School of Education
Howard W. Dillon (appointed June, 1967), Librarian, Harvard Graduate School of Education
†*Richard M. Durstine, Research Associate in Center for Studies in Education and Development; Lecturer in Education, Harvard Graduate School of Education
†*Allan B. Ellis, Director, Center for Educational Software Development, NESDEC; Lecturer in Education, Harvard Graduate School of Education

Herman F. Eschenbacher (resigned June, 1967), Librarian, Harvard Graduate School of Education (July, 1965-July 1967)

†*Wallace J. Fletcher, Research Associate, Harvard Graduate School of Education; President, Western Metropolitan Boston Regional Opportunity Council, Inc.

Thomas E. Kurtz (appointed June, 1967), Director, Kiewit Computation Center, Dartmouth College

†*Edward Landy, Assistant Superintendent of the Newton Public School System and Director of Pupil Personnel Services and Special Education, Newton Public School Department

Emmanuel G. Mesthene, Executive Director, University Program on Technology and Society, Harvard University

John D. Morine, Senior Supervisor, Occupational Information and Vocational Guidance, Division of Vocational Education, Department of Education, Commonwealth of Massachusetts

†*Robert P. O'Hara, Executive Director, Information System for Vocational Decisions

*Theodore R. Sizer, *ex officio;* Dean, Harvard Graduate School of Education

†*David V. Tiedeman, Chairman; Professor of Education, Harvard Graduate School of Education; Chairman, Executive Committee, Information System for Vocational Decisions

†*Michael J. Wilson, Executive Officer, New England Education Data Systems (resigned 1969)

Norman Zachary (resigned April, 1967), Director, Harvard Computing Center

† Principal Investigator
* Member of Executive Committee

## *Research Associates*

David K. Archibald (October, 1968- )
Roger D. Brown (Sept., 1968-July, 1969)
Duncan F. Circle (resigned June, 1968)
David B. Clemens (resigned June, 1967)
Thomas E. Hutchinson (December, 1968- )
Arthur M. Kroll (resigned June, 1967)
Lawrence Lerer (resigned December 1968)

Noel F. McGinn (resigned January, 1967)
Terence J. O'Mahoney (December, 1968- )
Stephen Purcell (summer, 1967)
Eugene H. Wilson (resigned October, 1968)

### *Systems Specialists*

David Brewster (resigned June, 1969)
Roy E. Norris, Jr.
Heather Scott
Graham Smith (Nov. 1968-Feb. 1969)
Ann W. Taylor

### *Programmers*

Toby Boyd (resigned October, 1968)
Arlene Scherer (resigned April, 1969)

### *Computer Operators*

M. Sue Kaiser
Marjorie Madoff

### *Principals (Newton School Department)*

Robert Frost
Muriel L. Lundy
Richard W. Mechem

### *Counselors (Newton School Department)*

James Hartman
Dorothy Kunberger
James McDade
Archibald Stark
Myra Trachtenberg

### *Script Writers*

Jon H. Abrahamson (summer, 1967)
Margaret Addis (summer, 1967)

Gerald Bazer (summer, 1967)
Joseph Clancy (summer, 1967)
Neil Curran (summer, 1967
Hope Danielson (summer, 1967)
Sara Eddy (summer, 1967)
Gail Gassen (summer, 1967)
James Hartman (summer, 1967)
Robert W. Hayes (summer, 1967)
Patricia Kelley( summer, 1967)
Frank Lambert (summer, 1967
Cecile P. LeClair( summer, 1967)
Paul H. Linscott (summer, 1967)
Peter A. Mackie (summer, 1967)
Dorothy A. Mahoney (summer, 1967)
James M. McGovern (summer, 1967)
Linda McLean (summer, 1967)
Carolyn Mellor (summer, 1967)
Emory Miller (summer, 1968)
William H. Moore, Jr. (summer, 1967)
Vivian Parker (summer, 1967)
Bruce Pelton (summer, 1967)
Catherine Psyhogios (summer, 1967)
Robert M. Rosenblatt (summer, 1967)
Howard Schofield (summer, 1967)
Anne Stamas (summer, 196[illegible])
Archibald Stark (summer, 1967)
Nancy Swidler (summer, 1967 and 1968)
Armine D. Thomason (summer, 1967)
Joseph M. Utka (summer, 1967)

## *Audio Visual Specialist*

Elaine Fisher (May, 1968- )

## *Administrative Assistants and Associate Editors*

Sara S. Booth (resigned April, 1969)
Sheila Leahy (April, 1969-Aug., 1969)
Nona D. Strauss (Sept., 1969- )

### *Research Assistants and Technicians*

Robert Aylmer, Jr.
Susan Baldwin (Oct. 1967-Mar. 1968)
Nancy Blackmun (summer, 1966)
Christopher Davis (summer, 1967)
Lawrence Dougherty (Sept. 1967-Sept. 1968)
Gordon A. Dudley (resigned August, 1967)
Patrick F. Ferrone (summer, 1966)
Lynne Fitzhugh (resigned 1968)
Myra T. Gannaway
Charles E. Gunnoe
Thomas E. Hutchinson (appointed Research Associate, December, 1968)
Diana J. Kronstadt (resigned July, 1968)
Sheila Leahy
Priscilla A. Little
Sandra J. Morse (summer, 1966)
Terence J. O'Mahoney (appointed Research Associate, December, 1968)
Margaret E. Pincus (resigned May, 1968)
Dana E. Quitslund (resigned December, 1968)
Charles Roehrig (May 1968-Sept. 1968)
Richard Roman
Susan Roman (resigned June 1969)
Stanley A. Schainker (resigned September, 1967)
Johanna Seltzer (resigned June, 1967)
Herbert Simons
Arnold Smith (February, 1968-June, 1968)
Dorothy S. Swithenbank (resigned September, 1968)
Thomas E. Swithenbank (resigned September, 1968)
Elizabeth Truesdell
Jo Weissman (June, 1968-August, 1968)
Esther Wiedman (resigned September 1968)
Charles S. Wetherell (resigned August, 1967)
Laurence Wolff (resigned October, 1967)
Patricia Yee
Barbara Zurer (resigned May, 1967)

## *Communications Technician*

Richard F. Topping

## *Secretaries*

Patricia Capen (summer, 1968)
Martha Drake
Dorothy Julia Emerson (resigned June, 1968)
Karen Guillette (resigned September, 1967)
Marietta Haley
Susan Hartman
Jacqueline Hargrove (resigned July, 1967)
Nadia Hurt (resigned February, 1967)
Linda LeBlanc
Alvis Martinez
Jean MacQuiddy (resigned April, 1967)
Wendy Mahon (resigned June, 1968)
Felice A. Merritt (resigned September, 1967)
Susan Morrison
Deborah Richardson
Wendy Simpson
Nona D. Strauss
Helen E. Topping

## *Clerks*

Jayne Lyons (resigned June, 1967)
Annette B. Miller (resigned June, 1968)
Mary A. O'Doherty (resigned June, 1967)

## *Keypunch Operator*

Dorothy Boudreau (September, 1968- )

## *Couriers*

James P. Dean (resigned June, 1968)
Dennis Horger (September, 1968-June, 1969)
Robert Sullivan (summer, 1968, 1969)

## *Consultants*

Frank L. Field, University of California at Santa Barbara (July, 1968)
Warren Gribbons, Regis College (summer, 1965)
Chris Kehas, Claremont Graduate School (summer, 1967)
Paul Lohnes, Project TALENT (summer and fall, 1967)
Esther Matthews, University of Oregon (summer, 1967)
Frank J. Minor (time contributed by International Business Machines Corp., Inc.)
Calvin Mooers, Rockford Research Institute, Inc. (summer and fall, 1966)
George D. Pasquella, Film Consultant (May, 1968)
Stanley Segal, Teachers College, Columbia University (summer, 1967)

## *Sub-Contractors*

Abt Associates (spring, 1967)
Computer Associates (spring and summer, 1967)

## *Visiting Researchers*

Fran Archambault, University of Connecticut
Roy Forbes, General Learning Corporation
John McManus, University of Connecticut
William Mittlestadt, Eastman Kodak Co.
Gary Stapleford, Sanders Associates
Selwyn Taylor, Sanders Associates
Keith Whitmore, Eastman Kodak Co.

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# V. Publications

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## TECHNICAL MEMORANDA

No. 1—"The Computer and Career Decisions" by Allan B. Ellis and Charles S. Wetherell.
No. 2—"Forecasting for Computer Aided Career Decisions: Survey of Methodology" by Russell G. Davis.
No. 3—"Level of Aspiration and Models Applicable to the Problem of Choice of Career" by Thomas E. Huchinson.

## PROJECT REPORTS

No. 1—"The Organization and Intention of a Proposed Data and Educational System for Vocational Decision-Making" by David V. Tiedeman.
No. 2—"An Information System for Vocational Decisions (ISVD): Cultivating the Possibility for Career through Operations" by David V. Tiedeman.
No. 3—"A Theoretical Foundation for the Use of Occupational Information in Guidance" by Robert P. O'Hara.
No. 4—"Suggestions for Treatment of Information about Occupations" by Richard M. Durstine.
No. 5—"Self Esteem Because of Collegiate Admission and Education" by David V. Tiedeman.
No. 6—"Forecasting for Computer Aided Decisions: Prospects and Procedures" by Richard M. Durstine.
No. 7—"A Task Oriented Course in Decision-Making" by Eugene H. Wilson.
No. 8—"Toward a Language of Supervision" by Wallace J. Fletcher, Lawrence Lerer, and Charles Gunnoe.

No. 9—"Recent Developments and Current Prospects in Occupational Fact Mediation" by David V. Tiedeman.

No. 10—"A Tentative Career Development Curriculum and its Implications for the Patterning of Supervisory Responsibilities in the Information System for Vocational Decisions" by Wallace J. Fletcher, Lawrence Lerer, and Charles Gunnoe.

No. 11—"A Rudimentary Demonstration for the Information System for Vocational Decisions: Orientation, Guidance Scripts, Test of Occupational Knowledge, and a Script Writing Language" by Allan B. Ellis, Robert P. O'Hara, and David V. Tiedeman.

No. 12—"The Role of Decision-Making in Information Generation: An Emerging New Potential in Guidance" by David V. Tiedeman.

No. 13—"Economic, Educational, and Personal Implications of Implementing Computerized Guidance Information Systems" by David V. Tiedeman.

No. 14—"Getting a Guidance Machine to Understand English" by Allan B. Ellis, Margaret E. Pincus, and Patricia Yee.

No. 15—"Datafiles for Computerized Vocational Guidance: Requirements, Preparation, Use" by Richard M. Durstine.

No. 16a—"Can a Machine Develop a Career? A Statement about the Processes of Exploration and Commitment in Career Development" by David V. Tiedeman.

No. 16b—"The Information System for Vocational Decisions: Description, Subsequent Development, and Implications" by David V. Tiedeman.

No. 17—"Can a Machine Counsel?" by Allan B. Ellis and David V. Tiedeman.

No. 18—"The Cultivation of Careers through Guidance and Vocational Education" by David V. Tiedeman.

No. 19—"Can a Machine Admit an Applicant to Continuing Education?" by David V. Tiedeman.

No. 20—"On the Concept of Purpose" by Frank L. Field of the University of California at Santa Barbara.

No. 21—"A Quasi-Annotated Sourcelist for Occupational Forecasting" by Patricia Yee.

During this year, O'Hara and Tiedeman submitted a chapter entitled "Occupational Facts and Their Use: Mediation and the Generation of Occupational Information" for publication in a planned volume entitled *Vocational and Technical Education Today* which is being assembled and edited by J. Kenneth Little and Gerald G. Somers at the University of Wisconsin Center for Studies in Vocational and Technical Education.

Also, Tiedeman revised and forwarded a paper now entitled "Comprehending Epigenesis in Decision-Making Development" for possible publication by Donald Super of the collection of papers presented at the XVIth International Congress, The International Association of Applied Psychologists, Amsterdam, The Netherlands, 18-22 August 1968.

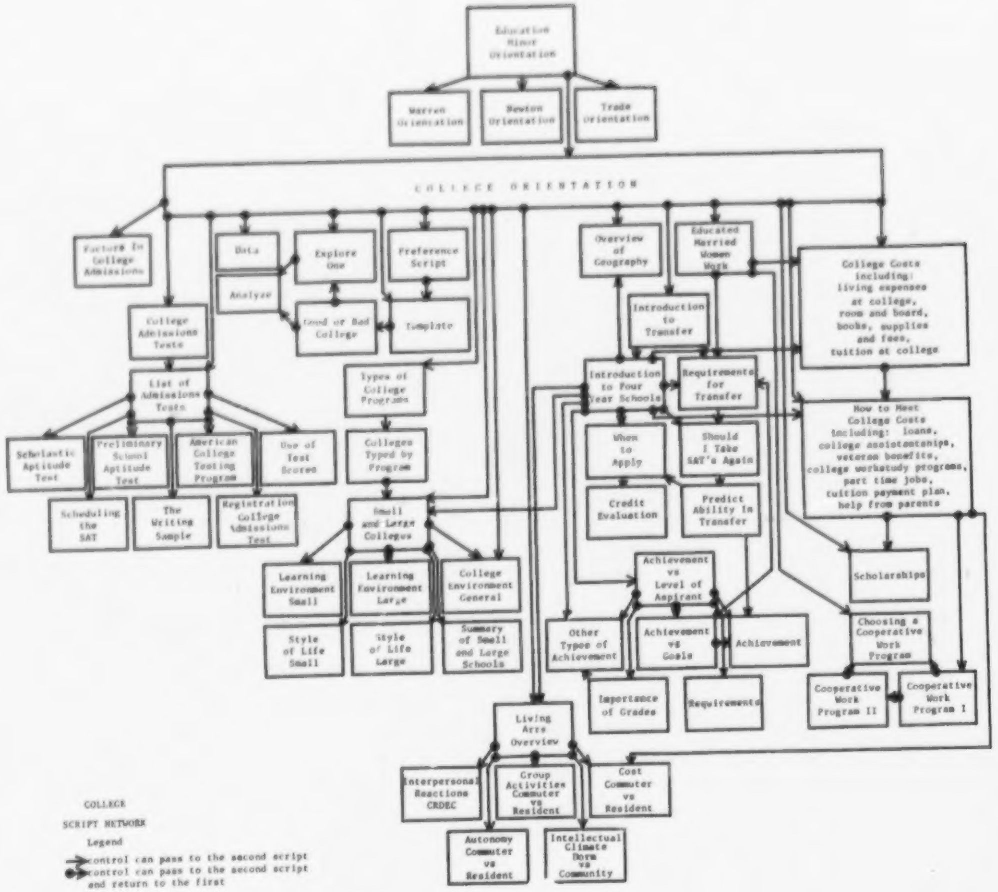
# VI. Appendices

Appendix I. College Script Network

Appendix II. Occupational Script Network

# APPENDIX I

## *College Script Network*


Education Minor Orientation
Warren Orientation
Newton Orientation
Trade Orientation
COLLEGE ORIENTATION
Factors In College Admissions
College Admissions Tests
List of Admissions Tests
Scholastic Aptitude Test
Preliminary School Aptitude Test
American College Testing Program
Use of Test Scores
Scheduling the SAT
The Writing Sample
Registration College Admissions Test
Data
Analyze
Explore One
Good or Bad College
Preference Script
Template
Types of College Programs
Colleges Typed by Program
Small and Large Colleges
Learning Environment Small
Learning Environment Large
College Environment General
Style of Life Small
Style of Life Large
Summary of Small and Large Schools
Overview of Geography
Educated Married Women Work
Introduction to Transfer
Introduction to Four Year Schools
Requirements for Transfer
When to Apply
Should I Take SAT's Again
Credit Evaluation
Predict Ability In Transfer
Achievement vs Level of Aspirant
Other Types of Achievement
Achievement vs Goals
Achievement
Importance of Grades
Requirements
College Costs including: living expenses at college, room and board, books, supplies and fees, tuition at college
How to Meet College Costs including: loans, college assistantships, veteran benefits, college workstudy programs, part time jobs, tuition payment plan, help from parents
Scholarships
Choosing a Cooperative Work Program
Cooperative Work Program II
Cooperative Work Program I
Living Arrs Overview
Interpersonal Reactions CRDEC
Group Activities Commuter vs Resident
Cost Commuter vs Resident
Autonomy Commuter vs Resident
Intellectual Climate Dorm vs Community

COLLEGE

SCRIPT NETWORK

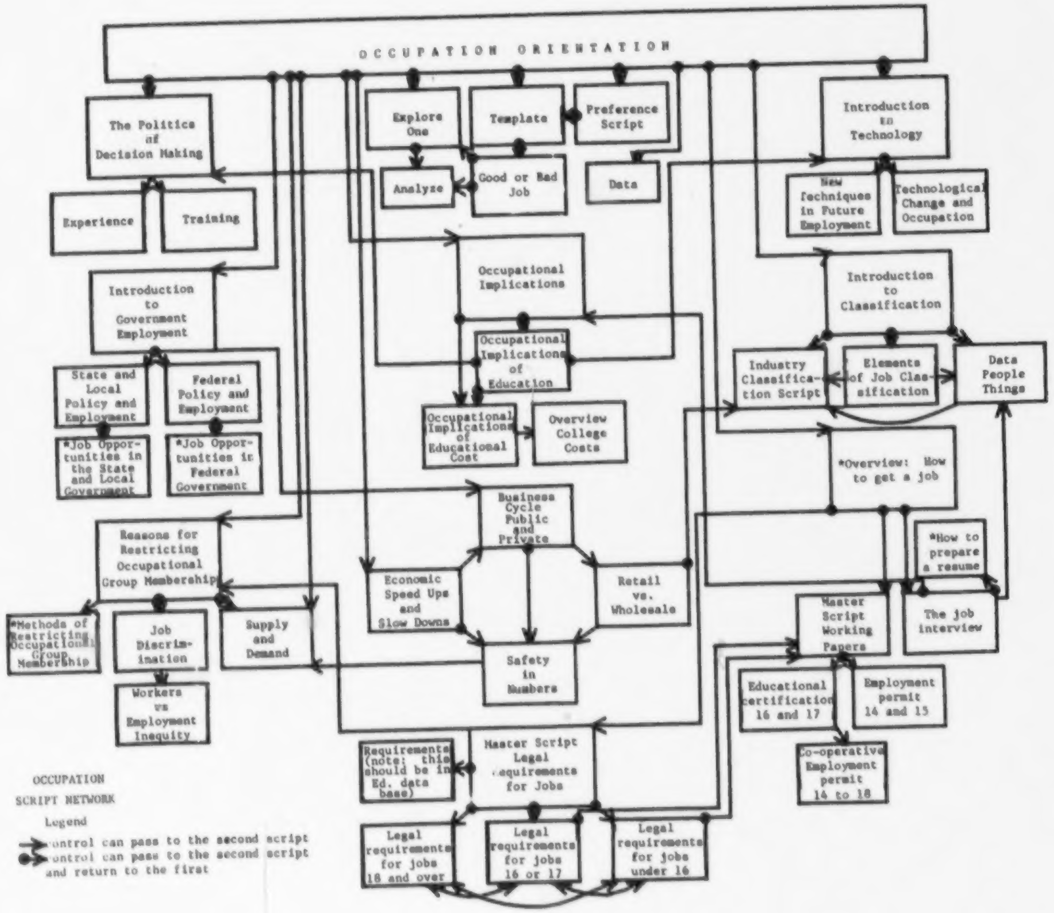
Legend

→ control can pass to the second script

●→ control can pass to the second script and return to the first

# APPENDIX II

## *Occupational Script Network*


OCCUPATION ORIENTATION
The Politics of Decision Making
Experience
Training
Introduction to Government Employment
State and Local Policy and Employment
Federal Policy and Employment
*Job Opportunities in the State and Local Government
*Job Opportunities in Federal Government
Reasons for Restricting Occupational Group Membership
*Methods of Restricting Occupational Group Membership
Job Discrimination
Workers vs Employment Inequity
Supply and Demand
Explore One
Template
Preference Script
Analyze
Good or Bad Job
Data
Occupational Implications
Occupational Implications of Education
Occupational Implications of Educational Cost
Overview College Costs
Business Cycle Public and Private
Economic Speed Ups and Slow Downs
Retail vs. Wholesale
Safety in Numbers
Master Script Legal Requirements for Jobs
Requirements (note: this should be in Ed. data base)
Legal requirements for jobs 18 and over
Legal requirements for jobs 16 or 17
Legal requirements for jobs under 16
Introduction to Technology
New Techniques in Future Employment
Technological Change and Occupation
Introduction to Classification
Industry Classification Script
Elements of Job Classification
Data People Things
*Overview: How to get a job
*How to prepare a resume
The job interview
Master Script Working Papers
Educational certification 16 and 17
Employment permit 14 and 15
Co-operative Employment permit 14 to 18

OCCUPATION
SCRIPT NETWORK

Legend
→ Control can pass to the second script
●→ Control can pass to the second script and return to the first

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